

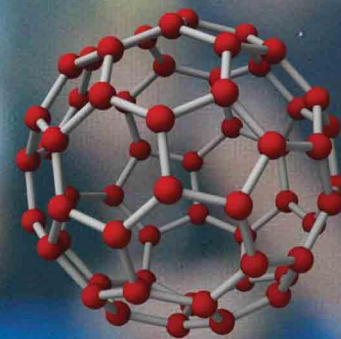


SCIENCE

Written as per the Latest Paper Pattern prescribed by NCERT

- Extensive coverage of competency based questions
- Subtopicwise segregation of questions
- Includes assertion-reason, case/ source based & HOT questions
- Covers All types of NCERT questions:
Textual exercise, Intext, Exemplar and Activities
- Includes competitive corner:
To give competitive edge to the students

Buckyball



An allotrope of carbon, Buckminsterfullerene or buckyball resembles a football. It is made of 60 atoms of carbon - an important constituent of our body.



CLASS X

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CBSE PERFECT PREP

SCIENCE

Class X

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- ☞ Subtopic-wise segregation for powerful concept building
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- ☞ Contains NCERT Exemplar Questions pertaining to the most recent textbook
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 - Memory maps
 - Chapter assessment
 - Assertion-Reason type Questions
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 - Important Formulae in relevant chapters
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 - Smart Recap
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 - Sample Question Paper (SQP), Additional Practice Question Paper (AQP): 2023-24
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- ☞ Includes **Q.R. Codes** for:
 - Concept explanation videos
 - Solutions to textbook activities
 - Formative assessments with solutions
 - Solutions to Practice Problems
 - Answers to Chapter assessments
- ☞ Includes Board Question Paper of **March 2024** (Solutions through Q.R. code)

Printed at: **Print to Print**, Mumbai

PREFACE

In the case of good books, the point is not how many of them you can get through, but rather how many can get through to you.

Target's 'CBSE Perfect Prep Science: Class X' is a complete, thorough, critically analysed and extensively drafted book to foster the student's confidence.

The **Subtopic-wise** classified format for each chapter of this book helps the students to comprehend concepts easily. Each subtopic in a chapter begins with brief theory followed by questions, divided into **Objective Questions** (MCQs & Assertion-Reason), **Subjective Questions** (Very Short Answer Questions, Short Answer Questions, Long Answer Questions & Case / Source based Questions). Textual Exercise Questions, Intext Questions, Exemplar Questions and Higher Order Thinking (HOT) Questions are included according to the flow of a subtopic.

The **competency based questions** which assess the application of concept in real life situations are covered extensively throughout the book.

Important Formulae for relevant chapters are provided for handy revision followed by **Practice Problems** to further promote the numerical solving skill. **Memory Map** and **Competitive Corner** are placed before Chapter Assessment.

Solved questions from the latest **Sample Question Paper (SQP)**, **Additional Question Paper (AQP)**, **Competency Focussed Practice Questions handbook** and **Previous Years' Board Papers** (up to 2023) are covered in the book.

A **Chapter Assessment** is designed as per the latest pattern of the examination. It stands as a testimony to the fact that the child has understood the chapter thoroughly.

The **Board Question Paper of March 2024** is provided at the end of the book and its solution can be accessed through **Q.R. code**.

Solutions to **Chapter Assessments, Textbook Activities & Practice Problems** are provided via **Q.R. codes**. **Formative Assessments** along with their solutions (which cover a wide range of activities and problems and are useful in preparation of internal assessment) can be accessed via **Q.R. codes**.

While ensuring the complete coverage of the syllabus in an effortless and easy to grasp format, emphasis is also given on active learning. To achieve this, we have infused several titles such as, **Smart Recap, Enrich your knowledge, Smart Code, Reading Between the Lines, Caution, Gyan Guru, Connections and Competitive Corner**.

The flow chart on the adjacent page will walk you through the key features of the book and elucidate how they have been carefully designed to maximize the student learning.

A book affects eternity; one can never tell where its influence stops.

The journey to create a complete book is strewn with triumphs, failures and near misses. If you think we've nearly missed something or want to applaud us for our triumphs, we'd love to hear from you. Please write to us on: mail@targetpublications.org

Publisher

Edition: Fifth

Disclaimer

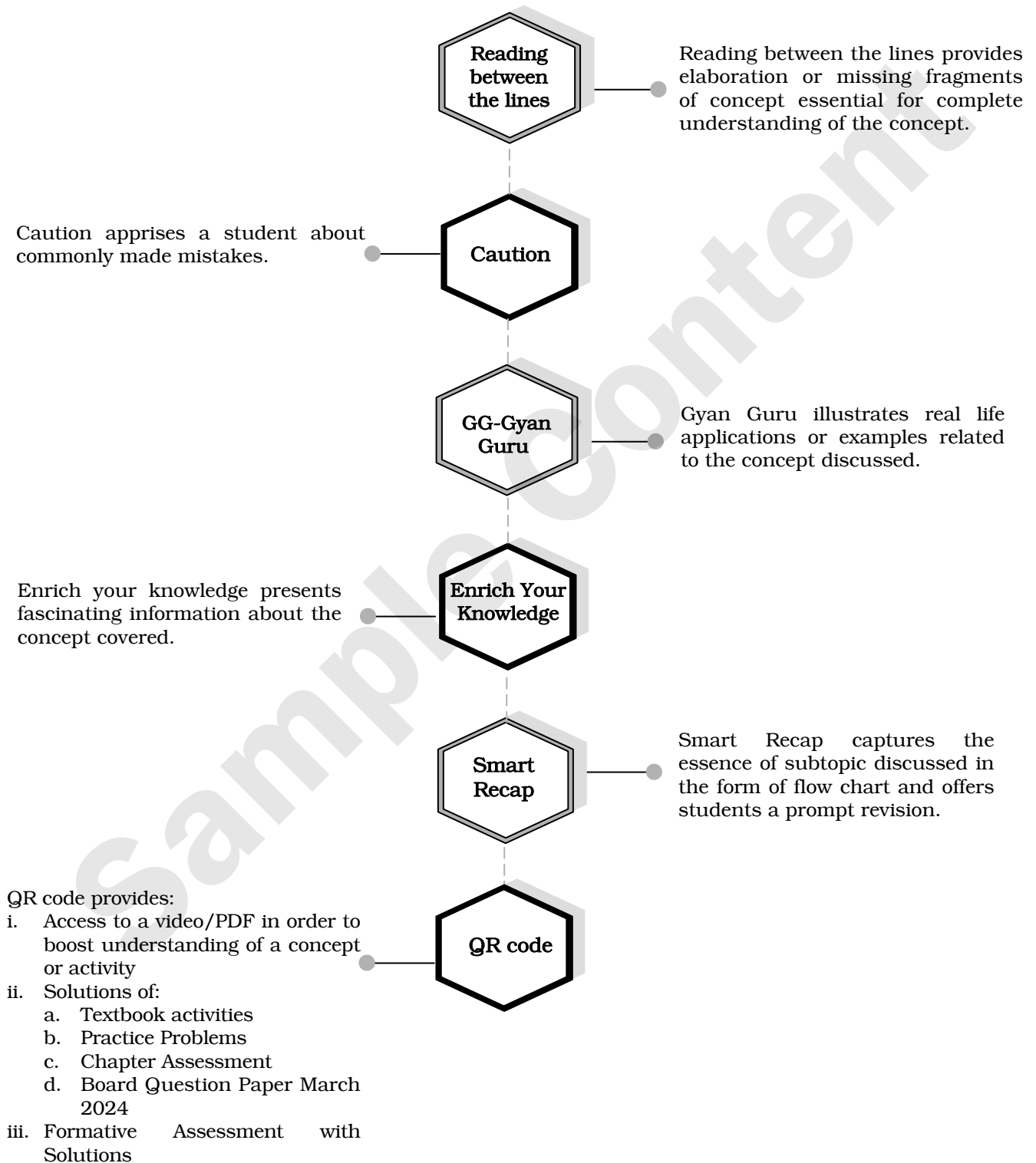
This reference book is transformative work based on the latest Science Textbook for class X, Rationalised published by the National Council of Educational Research and Training (NCERT) and NCERT Exemplar: 2018 published by the National Council of Educational Research and Training (NCERT) and the Department of Education in Science & Mathematics (DESM). We the publishers are making this reference book which constitutes as fair use of textual contents which are transformed by adding and elaborating, with a view to simplify the same to enable the students to understand, memorize and reproduce the same in examinations.

This work is purely inspired upon the course work as prescribed by the National Council of Educational Research and Training (NCERT). Every care has been taken in the publication of this reference book by the Authors while creating the contents. The Authors and the Publishers shall not be responsible for any loss or damages caused to any person on account of errors or omissions which might have crept in or disagreement of any third party on the point of view expressed in the reference book.

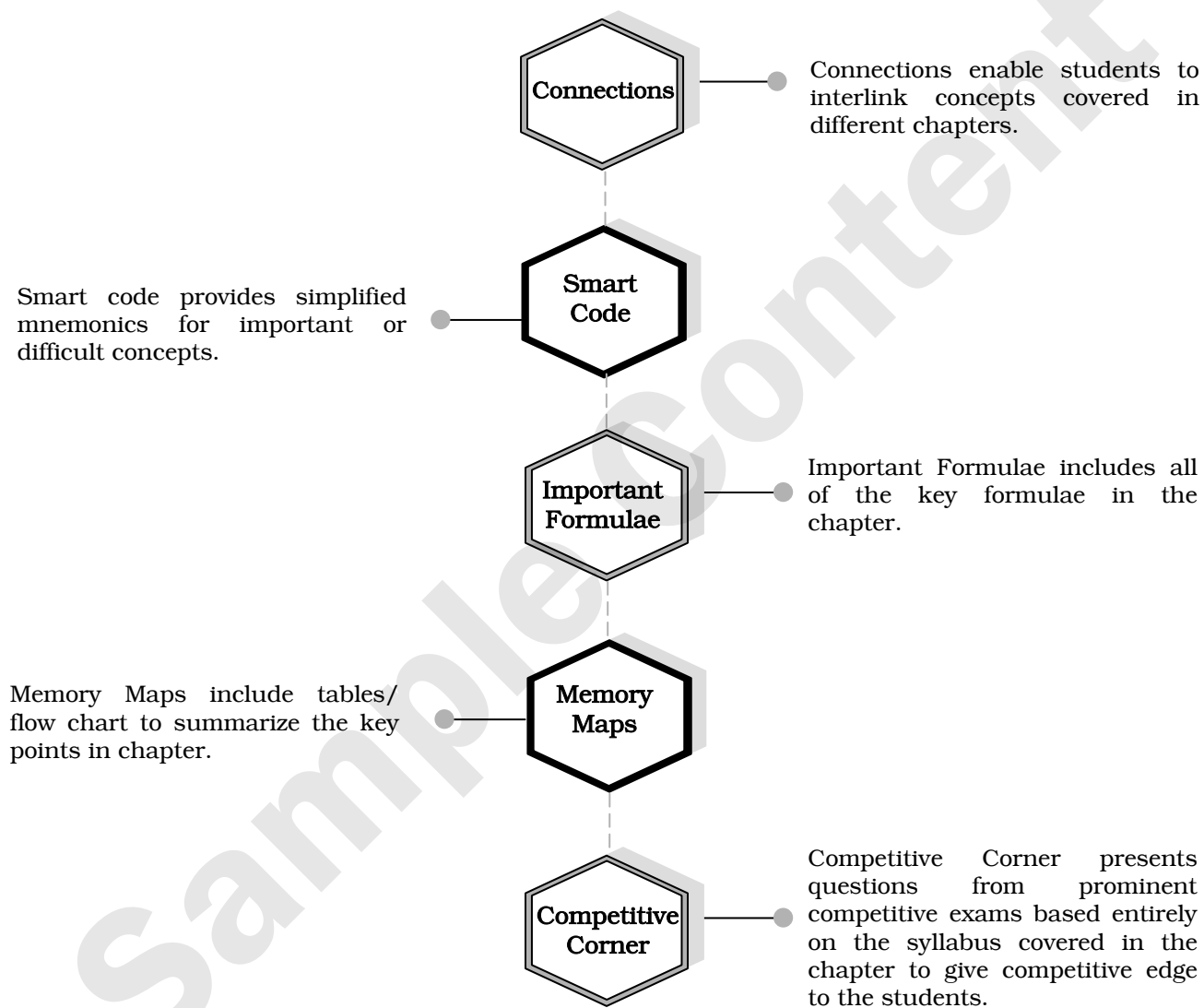
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KEY FEATURES



Continued...



COURSE STRUCTURE 2023 - 24

CLASS X (Annual Examination)

Marks: 80

Unit No.	Unit	Marks
I	Chemical Substances-Nature and Behaviour	25
II	World of Living	25
III	Natural Phenomena	12
IV	Effects of Current	13
V	Natural Resources	05
	Total	80
	Internal Assessment	20
	Grand Total	100

Theme: Materials

Unit I: Chemical Substances - Nature and Behaviour

Chemical reactions: Chemical equation, Balanced chemical equation, implications of a balanced chemical equation, types of chemical reactions: combination, decomposition, displacement, double displacement, precipitation, endothermic exothermic reactions, oxidation and reduction.

Acids, bases and salts: Their definitions in terms of furnishing of H^+ and OH^- ions, General properties, examples and uses, neutralization, concept of pH scale (Definition relating to logarithm not required), importance of pH in everyday life; preparation and uses of Sodium Hydroxide, Bleaching powder, Baking soda, Washing soda and Plaster of Paris.

Metals and nonmetals: Properties of metals and non-metals; Reactivity series; Formation and properties of ionic compounds; Basic metallurgical processes; Corrosion and its prevention.

Carbon compounds: Covalent bonding in carbon compounds. Versatile nature of carbon. Homologous series. Nomenclature of carbon compounds containing functional groups (halogens, alcohol, ketones, aldehydes, alkanes and alkynes), difference between saturated hydro carbons and unsaturated hydrocarbons. Chemical properties of carbon compounds (combustion, oxidation, addition and substitution reaction). Ethanol and Ethanoic acid (only properties and uses), soaps and detergents.

Theme: The World of the Living

Unit II: World of Living

Life processes: 'Living Being'. Basic concept of nutrition, respiration, transport and excretion in plants and animals.

Control and co-ordination in animals and plants: Tropic movements in plants; Introduction of plant hormones; Control and co-ordination in animals: Nervous system; Voluntary, involuntary and reflex action; Chemical co-ordination: animal hormones.

Reproduction: Reproduction in animals and plants (asexual and sexual) reproductive health - need and methods of family planning. Safe sex vs HIV/AIDS. Child bearing and women's health.

Heredity and Evolution: Heredity; Mendel's contribution- Laws for inheritance of traits: Sex determination: brief introduction: (topics excluded - evolution; evolution and classification and evolution should not be equated with progress).

Theme: Natural Phenomena
Unit III: Natural Phenomena

Reflection of light by curved surfaces; Images formed by spherical mirrors, centre of curvature, principal axis, principal focus, focal length, mirror formula (Derivation not required), magnification.

Refraction; Laws of refraction, refractive index.

Refraction of light by spherical lens; Image formed by spherical lenses; Lens formula (Derivation not required); Magnification. Power of a lens.

Functioning of a lens in human eye, defects of vision and their corrections, applications of spherical mirrors and lenses.

Refraction of light through a prism, dispersion of light, scattering of light, applications in daily life (excluding colour of the sun at sunrise and sunset).

Theme: How Things Work
Unit IV: Effects of Current

Electric current, potential difference and electric current. Ohm's law; Resistance, Resistivity, Factors on which the resistance of a conductor depends. Series combination of resistors, parallel combination of resistors and its applications in daily life. Heating effect of electric current and its applications in daily life. Electric power, Interrelation between P, V, I and R.

Magnetic effects of current : Magnetic field, field lines, field due to a current carrying conductor, field due to current carrying coil or solenoid; Force on current carrying conductor, Fleming's Left Hand Rule, Direct current. Alternating current: frequency of AC. Advantage of AC over DC. Domestic electric circuits.

Theme: Natural Resources
Unit V: Natural Resources

Our environment: Eco-system, Environmental problems, Ozone depletion, waste production and their solutions. Biodegradable and non-biodegradable substances.

Note:

The NCERT text books present information in boxes across the book. These help students to get conceptual clarity. However, the information in these boxes would not be assessed in the year-end examination.

PRACTICALS

Practical should be conducted alongside the concepts taught in theory classes

List of Experiments

- A. Finding the pH of the following samples by using pH paper/universal indicator: Unit-I

a. Dilute Hydrochloric Acid	b. Dilute NaOH solution
c. Dilute Ethanoic Acid solution	d. Lemon juice
e. Water	f. Dilute Hydrogen Carbonate solution

B. Studying the properties of acids and bases (HCl & NaOH) on the basis of their reaction with: Unit-I

a. Litmus solution (Blue/Red)	b. Zinc metal
c. Solid sodium carbonate	
- Performing and observing the following reactions and classifying them into: Unit-I

a. Combination reaction	b. Decomposition reaction
c. Displacement reaction	d. Double displacement reaction

 - Action of water on quick lime.
 - Action of heat on ferrous sulphate crystals.
 - Iron nails kept in copper sulphate solution
 - Reaction between sodium sulphate and barium chloride solutions

3. Observing the action of Zn, Fe, Cu and Al metals on the following salt solutions: **Unit-I**
a. $\text{ZnSO}_{4(aq)}$ b. $\text{FeSO}_{4(aq)}$ c. $\text{CuSO}_{4(aq)}$ d. $\text{Al}_2(\text{SO}_4)_3(aq)$
Arranging Zn, Fe, Cu and Al (metals) in the decreasing order of reactivity based on the above result.
4. Studying the dependence of potential difference (V) across a resistor on the current (I) passing through it and determine its resistance. Also plotting a graph between V and I. **Unit-IV**
5. Determination of the equivalent resistance of two resistors when connected in series and parallel. **Unit-IV**
6. Preparing a temporary mount of a leaf peel to show stomata. **Unit-II**
7. Experimentally show that carbon dioxide is given out during respiration. **Unit-II**
8. Study of the following properties of acetic acid (ethanoic acid): **Unit-I**
i. Odour
ii. solubility in water
iii. effect on litmus
iv. reaction with Sodium Hydrogen Carbonate
9. Study of the comparative cleaning capacity of a sample of soap in soft and hard water. **Unit-I**
10. Determination of the focal length of: **Unit-III**
i. Concave mirror
ii. Convex lens
by obtaining the image of a distant object.
11. Tracing the path of a ray of light passing through a rectangular glass slab for different angles of incidence. Measure the angle of incidence, angle of refraction, angle of emergence and interpret the result. **Unit-III**
12. Studying (a) binary fission in Amoeba, and (b) budding in yeast and Hydra with the help of prepared slides. **Unit-II**
13. Tracing the path of the rays of light through a glass prism. **Unit-III**
14. Identification of the different parts of an embryo of a dicot seed (Pea, gram or red kidney bean). **Unit-II**

Assessment Areas (Theory) 2023-24

Assessment Areas (2023 - 24)

Theory - Total Max. Marks: 80

No.	Competencies	Total
1	Demonstrate Knowledge and Understanding	46%
2	Application of Knowledge/Concepts	22%
3	Formulate, Analyze, Evaluate and Create	32%
	Total	100%

Note:

- Typology of Questions: VSA including objective type questions, Assertion – Reasoning type questions; SA; LA; Source-based/ Case-based/ Passage-based/ Integrated assessment questions.
- An internal choice of approximately 33% would be provided.

CONTENTS

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- Note:**
- * mark represents Textual question.
 - # mark represents Intext question.
 - ⌘ mark represents NCERT Exemplar question.
 - 🧠 symbol represents HOT (Higher Order Thinking) question.

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1

Chemical Reactions and Equations

Contents & Concepts

1.0 Introduction

1.1 Chemical equations

1.2 Types of chemical reactions

1.3 Oxidation reactions in everyday life

1.0 Introduction

Whenever a chemical change occurs, it is said that a chemical reaction has taken place. Following observations help to determine whether a chemical reaction has taken place:

- i. change in state
- ii. change in colour
- iii. evolution of a gas
- iv. change in temperature

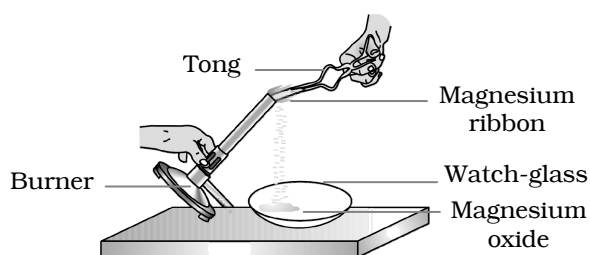
Objective Questions

Multiple Choice Questions

[1 Mark]

1. Which of the following is a chemical change?
 - (A) Melting of ice
 - (B) Digestion of food
 - (C) Evaporation of water
 - (D) Dissolution of salt in water
2. Which of the following is not a physical change?
 - (A) Boiling of water to give water vapour
 - (B) Melting of ice to give water
 - (C) Dissolution of salt in water
 - (D) Combustion of Liquefied Petroleum Gas (LPG)

3.



Which of the following is the correct observation of the reaction shown in the given set up?

[CBSE SQP 2022-23]

- (A) Brown powder of magnesium oxide is formed.
- (B) Colourless gas which turns lime water milky is evolved.
- (C) Magnesium ribbon burns with brilliant white light.
- (D) Reddish brown gas with a smell of burning sulphur has evolved.

Subjective Questions

Very Short Answer Questions

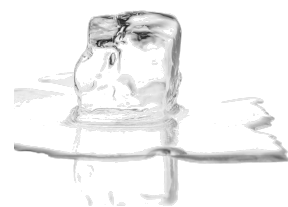
[2 Marks]

1. Grapes hanging on the plant do not ferment but after being plucked from the plant can be fermented. Under what conditions do these grapes ferment? Is it a chemical or physical change?

Ans:

- i. Microbes can grow in plucked grapes and under anaerobic conditions these grapes can get fermented.
- ii. It is a chemical change.

2. Which one is a chemical change—rusting of iron screw or melting of ice? Justify your answer.



Ans: Rusting of iron screw is a chemical change as a new substance is formed.

Melting of ice involves a physical change and no new substance is formed.



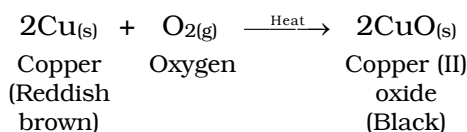
3. Using suitable chemical equation, justify that some chemical reactions are determined by:

- i. Change in colour
- ii. Change in temperature

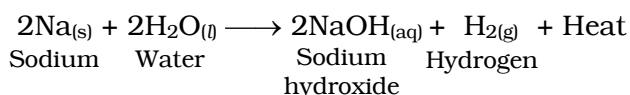
[CBSE 2011]

Ans:

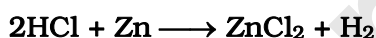
- i. When copper powder is heated in air, the reddish brown coloured copper changes to black copper (II) oxide. Thus, change in colour indicates that a chemical reaction has taken place.



- ii. Sodium reacts with water vigorously to form sodium hydroxide and hydrogen gas releasing a large amount of heat. As a result, the temperature of the reaction mixture increases. Thus, change in temperature indicates that a chemical reaction has taken place.



4. In a test-tube, hydrochloric acid is poured over a few zinc granules. List two observations which suggest that a chemical reaction has occurred.



Also, state one difference between a physical change and a chemical change.

Ans:

- i. Temperature of test tube increases.
 - ii. A colourless gas is evolved.
- In physical change, only the physical state of the substance changes but its chemical composition remains same. However, in chemical change, substance with different chemical properties and composition is formed.

Short Answer Questions

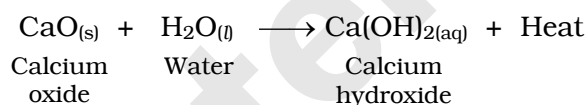
[3 Marks]

1. Write some observations in an activity which may suggest that a chemical reaction has taken place. Give one example in support of your answer.

Ans:

- i. In an activity, when any of the following occurs, it suggests that a chemical reaction has taken place:
 - a. change in state
 - b. change in colour
 - c. change in temperature
 - d. evolution of gas
- ii. In an activity, change in state and change in temperature indicate that a chemical reaction has taken place:

eg. Calcium oxide reacts vigorously with water to produce slaked lime (calcium hydroxide) releasing a large amount of heat.



¶2. Which among the following are physical or chemical changes?

- i. Evaporation of petrol
- ii. Burning of Liquefied Petroleum Gas (LPG)
- iii. Heating of an iron rod to red hot
- iv. Curdling of milk
- v. Sublimation of solid ammonium chloride

Ans: **Physical changes:** Evaporation of petrol, heating of an iron rod to red hot, sublimation of solid ammonium chloride.

Chemical changes: Burning of Liquefied Petroleum Gas (LPG), curdling of milk.

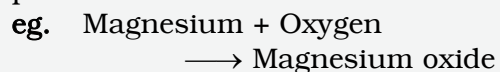
1.1 Chemical equations

Chemical reaction is a process in which one or more substances, called **reactants**, undergo a chemical change to produce new substances called **products**. The properties of the products are different from that of the reactants.

Chemical reactions are represented in terms of chemical equations.

- **Different ways of representing a chemical reaction:**

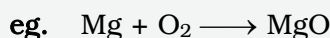
- i. **Word equation:** It is represented using names of reactants and products.





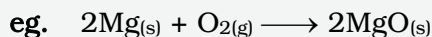
ii. **Skeletal chemical equation:** It is represented using symbols and formulae of reactants and products. It is an unbalanced chemical equation.

If the number of atom(s) of each element in the reactants is not equal to the number of atom(s) of that element in the products, then the chemical equation is said to be an unbalanced chemical equation.



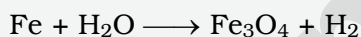
iii. **Balanced chemical equation:** It is represented using symbols and formulae of reactants and products. It may include physical states and reaction conditions.

A chemical equation in which the numbers of atoms of each element on both the sides of the equation are equal is called a balanced chemical equation.



• **Balancing of chemical equation:**

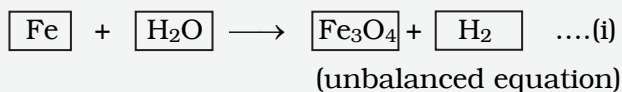
Consider the following reaction:



In above reaction, only one iron (Fe) atom is present on the left hand side (LHS) while three iron (Fe) atoms are present on the right hand side (RHS). Therefore, it is an unbalanced chemical equation.

Steps involved in the balancing of a chemical equation:

Step I – Rewrite the given equation as it is and draw a box around each chemical formula on the LHS and RHS. Do not change anything inside the boxes while balancing the equation.



Step II – Write the number of atoms of elements present in reactants and in products in a tabular form.

Name of element	Number of atoms in reactants (LHS)	Number of atoms in products (RHS)
Iron (Fe)	1	3
Hydrogen (H)	2	2
Oxygen (O)	1	4

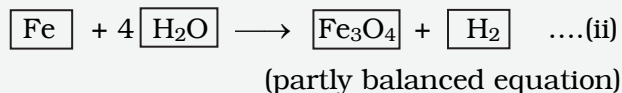
Step III – Start balancing with the compound that contains the maximum number of atoms. It may be a reactant or a product. From that compound, select the element which has the maximum number of atoms. Thus, from the given equation, compound Fe_3O_4 and the element oxygen in it should be selected.

There are four oxygen atoms on the RHS and only one on the LHS.

	Atoms of oxygen	In reactants	In products
i.	Initial	1 (in H_2O)	4 (in Fe_3O_4)
ii.	To balance	1×4	4

Thus, to balance the oxygen atoms on both sides, put coefficient '4' before the formula ' H_2O ' on the LHS.

Now, the partly balanced equation becomes



Step IV – In equation (ii), Fe and H atoms are still not balanced. Select any one of these elements to proceed further.

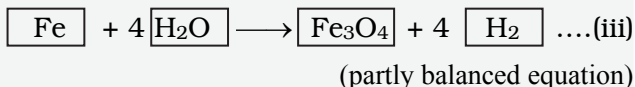
There are eight hydrogen atoms on the LHS and only two on the RHS.

	Atoms of hydrogen	In reactants	In products
i.	Initial	8 (in $4\text{H}_2\text{O}$)	2 (in H_2)
ii.	To balance	8	2×4

Thus, to balance the hydrogen atoms on both sides, put coefficient '4' before the formula ' H_2 ' on the RHS.



The equation would now be

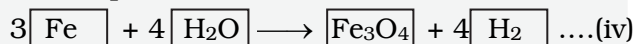


Step V – In the equation (iii), the third element i.e., iron (Fe) is still not balanced. There are three iron atoms on the RHS and only one on the LHS.

	Atoms of iron	In reactants	In products
i.	Initial	1 (in Fe)	3 (in Fe ₃ O ₄)
ii.	To balance	1 × 3	3

Thus, to balance the iron atoms on both sides, put coefficient '3' before the symbol 'Fe' on the LHS.

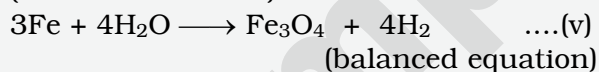
The equation would now be –



Step VI – Check the correctness of the balanced equation by counting the atoms of each element on both sides of the equation.

Name of element	Number of atoms in reactants (LHS)	Number of atoms in products (RHS)
Iron (Fe)	3	3
Hydrogen (H)	8	8
Oxygen (O)	4	4

Write the correct balanced equation (without the boxes) as follows:



Note:

- The above method of balancing chemical equation is called **hit and trial** method as the trials are made to balance the equation by using the smallest whole number coefficient.
- Many other chemical equations can be balanced by carrying out the similar steps as shown above.

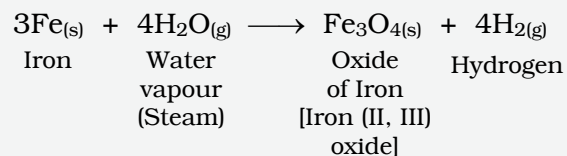
Step VII – Writing symbols of physical states of reactants and products:

By writing the physical states of reactants and products, a chemical equation becomes more informative.

- Solid state is represented by symbol (s).
- Liquid state is represented by symbol (l).

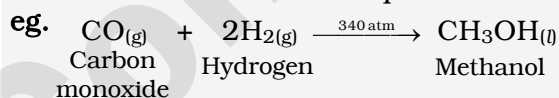
- Gaseous state is represented by symbol (g).
- Aqueous solution is represented by symbol (aq).

The balanced equation (v) becomes



Note:

- The symbol (g) is used with H₂O to indicate that in this reaction water is used in the form of steam.
- Physical states are usually not included in a chemical equation unless it is necessary to specify them.
- Writing the condition in which reaction takes place:** The condition in which reaction takes place is generally written above or below the arrow of a chemical equation.



Objective Questions

Multiple Choice Questions [1 Mark]

- Which of the following processes involve chemical reaction?
 - Storing of oxygen gas under pressure in a gas cylinder.
 - Liquefaction of air.
 - Keeping petrol in a china dish in the open.
 - Heating copper wire in presence of air at high temperature.**
- Which of the following is a NECESSARY condition for ALL chemical reactions?

[CBSE Competency Focused Practice Questions 2022-23]

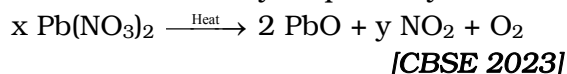
 - The reactants should be in the same state.
 - Energy should be supplied to the reactants.
 - The reactants should be at the same temperature.
 - There should be physical contact between the reactants.**



3. In which of the following chemical equations, the abbreviations represent the correct states of the reactants and products involved at reaction temperature?

- (A) $2\text{H}_2(l) + \text{O}_2(l) \longrightarrow 2\text{H}_2\text{O}(g)$
 (B) $2\text{H}_2(g) + \text{O}_2(l) \longrightarrow 2\text{H}_2\text{O}(l)$
 (C) $2\text{H}_2(g) + \text{O}_2(g) \longrightarrow 2\text{H}_2\text{O}(l)$
 (D) $2\text{H}_2(g) + \text{O}_2(g) \longrightarrow 2\text{H}_2\text{O}(g)$

4. In order to balance the following chemical equation, the values of the coefficients x and y respectively are:



- (A) 2, 4 (B) 2, 2
 (C) 2, 3 (D) 4, 2

5. Given below is the balanced chemical equation for the thermal decomposition of lead nitrate.



Which of the following information does the coefficients of PbO and NO₂ in the equation (2 and 4 respectively) tell us?

[CBSE Competency Focused Practice Questions 2022-23]

- (A) the ratio of the number of moles produced of the two substances
 (B) the ratio of the number of atoms in the two substances
 (C) the ratio of the mass produced of the two substances
 (D) the ratio of the densities of the two substances

6. The following reactions are carried out in open vessels.

- (P) $2\text{Cu}(s) + \text{O}_2(g) \xrightarrow{\text{Heat}} 2\text{CuO}(s)$
 (Q) $\text{Zn}(s) + \text{CuSO}_4(aq) \longrightarrow \text{ZnSO}_4(aq) + \text{Cu}(s)$
 (R) $2\text{FeSO}_4(s) \xrightarrow{\text{Heat}} \text{Fe}_2\text{O}_3(s) + \text{SO}_2(g) + \text{SO}_3(g)$

Which of the following CORRECTLY shows if the weight of the reaction vessel and contents increases, decreases or remains the same after the reaction as compared to before the reaction?

Option	Reaction P	Reaction Q	Reaction R
A	decreases	remains the same	increases
B	remains the same	increases	decreases

C	increases	decreases	increases
D	increases	remains the same	decreases

- (A) A (B) B
 (C) C (D) D

Hint: As the reactions are carried in open vessels, gaseous reactants and gaseous products will not contribute to the weight of the reaction vessel and contents.

In reaction P, since one of the reactant is a gas, the weight of the reaction vessel and contents increases after the reaction.

In reaction Q, since the reactants and the products are in solid and aqueous state, the weight of the reaction vessel and contents remains the same after the reaction.

In reaction R, since two products are gases, the weight of the reaction vessel and contents decreases after the reaction.

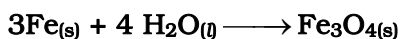
Subjective Questions

#1. Why should a magnesium ribbon be cleaned before burning in air?

Ans: When magnesium ribbon is exposed to air, it reacts with oxygen in the air to form magnesium oxide. This oxide layer interferes with the burning of magnesium ribbon.

Thus, the magnesium ribbon should be cleaned using sand paper before burning in air.

2. The following chemical equation does not represent a chemical reaction that can take place,



State what needs to be changed in the equation above for it to represent the correct reaction between Fe and H₂O.

[CBSE Competency Focused Practice Questions 2022-23]

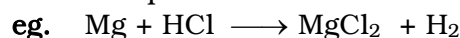
Ans: In the chemical reaction, the reactant water (H₂O) should be in the form of steam and not liquid. Therefore, in the given equation, the physical state of H₂O needs to be changed from (l) to (g).


Very Short Answer Questions [2 Marks]

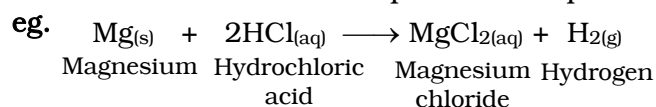
1. What is meant by skeletal chemical equation? Using suitable chemical reaction, differentiate between a skeletal chemical equation and a balanced chemical equation. [CBSE 2011]

Ans:

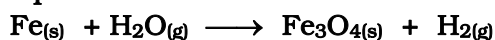
i. Skeletal chemical equation is a representation of a chemical reaction using chemical formulae of reactants and products and it is unbalanced.



ii. In balanced chemical equation, the numbers of atoms of each element on both the sides of the equation are equal.

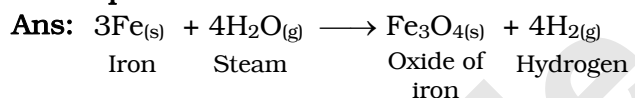


2. A student writes an unbalanced equation as:



Balance the above reaction.

Name and state the law which is kept in mind while we balance a chemical equation.



Law of conservation of mass is kept in mind while balancing a chemical equation.

The law states that matter can neither be created, nor be destroyed. (i.e., during chemical reaction, total mass of reactants and products remains the same).

[Note: Students can scan the Q.R. code in Quill - The Padhai App to get conceptual clarity with the aid of a relevant video.]

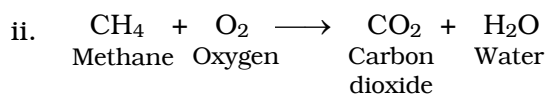
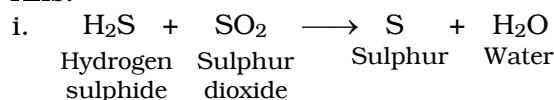


3. Write the skeletal equations for the following reactions:

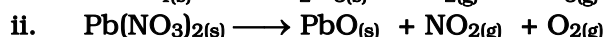
i. Hydrogen sulphide reacts with sulphur dioxide to form sulphur and water.

ii. Methane on burning combines with oxygen to produce carbon dioxide and water. [CBSE 2012]

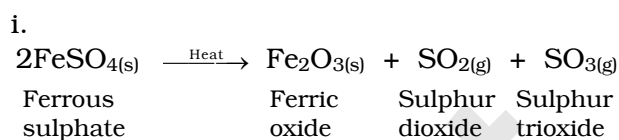
Ans:



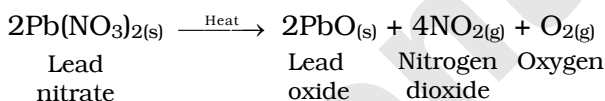
4. Balance the given chemical reactions:



Ans:

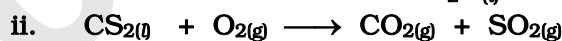
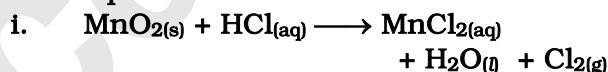


ii.

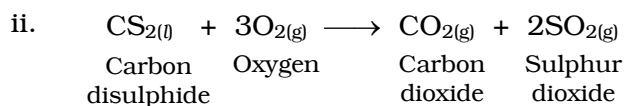
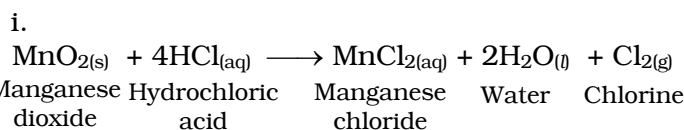

CAUTION

When balancing the given chemical equation, do not to alter the formulae of the compounds or elements involved in the reaction.

5. Balance the following chemical equation:



Ans:

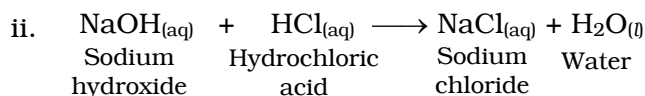
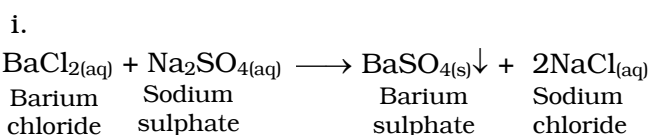


- #6. Write a balanced chemical equation with state symbols for the following reactions.

i. Solutions of barium chloride and sodium sulphate in water react to give insoluble barium sulphate and the solution of sodium chloride.

ii. Sodium hydroxide solution (in water) reacts with hydrochloric acid solution (in water) to produce sodium chloride solution and water.

Ans:



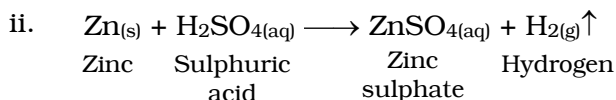
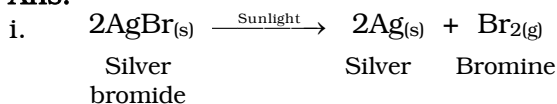


7. Write balanced chemical equations for the following reactions:

- Silver bromide on exposure to sunlight decomposes into silver and bromine.
- Zinc reacts with sulphuric acid to form zinc sulphate and hydrogen gas.

[CBSE 2012]

Ans:

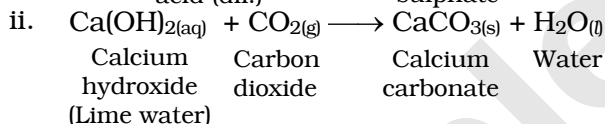
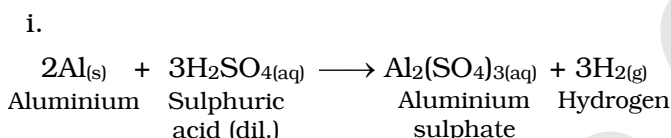


8. Write balanced chemical equations for the following reactions:

- Dilute sulphuric acid reacts with aluminium powder.
- Carbon dioxide is passed through lime water.

[CBSE 2013]

Ans:

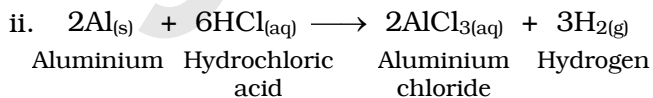
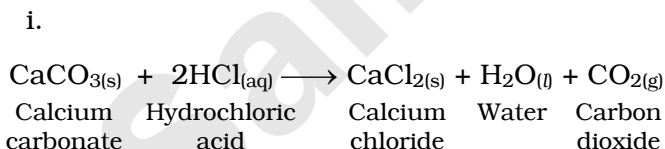


9. Complete and balance the following chemical equations:

- $\text{CaCO}_3 + \text{HCl}$
- $\text{Al} + \text{HCl}$

[CBSE 2014]

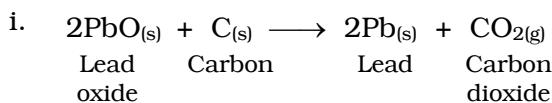
Ans:



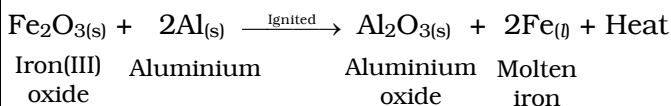
10. Balance the following chemical equations:

- $\text{PbO} + \text{C} \longrightarrow \text{Pb} + \text{CO}_2$
- $\text{Fe}_2\text{O}_3 + \text{Al} \longrightarrow \text{Al}_2\text{O}_3 + \text{Fe} + \text{Heat}$

Ans:



ii.



Short Answer Questions [3 Marks]

*1. What is a balanced chemical equation? Why should chemical equation be balanced?

Ans:

i. A balanced chemical equation is the one in which total number of atoms of each element is equal on both sides of the equation.

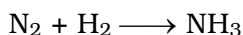
ii. The number of atoms of each element on both sides of the chemical equation should be equal because as per law of conservation of mass, mass can neither be created nor be destroyed. Total mass of the elements present in the products of a chemical reaction has to be equal to the total mass of the elements present in reactants. Thus, a chemical equation should always be balanced.

2. Write the steps for balancing the chemical equation for the formation of ammonia by the combination of nitrogen and hydrogen.

[CBSE 2014]

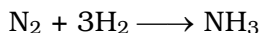
Ans:

i. First, write unbalanced equation for the given reaction.

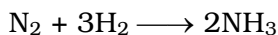


ii. Examine the number of atoms of each element present in the unbalanced equation.

iii. To balance hydrogen on left hand side, put coefficient '3' as '3H₂'.

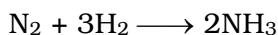


iv. To balance hydrogen atoms on right hand side, put coefficient '2' as '2NH₃'.



v. Now consider the element nitrogen. Nitrogen atoms are 2, on both, left- and right-hand side.

vi. Thus, balanced chemical equation is:





#3. Write the balanced equation for the following chemical reactions.

- Hydrogen + chlorine
→ Hydrogen chloride
- Barium chloride + Aluminium sulphate
→ Barium sulphate + Aluminium chloride.
- Sodium + Water
→ Sodium hydroxide + Hydrogen

Ans:

- $$\text{H}_{2(\text{g})} + \text{Cl}_{2(\text{g})} \longrightarrow 2\text{HCl}_{(\text{g})}$$

Hydrogen Chlorine Hydrogen chloride
- $$3\text{BaCl}_{2(\text{aq})} + \text{Al}_2(\text{SO}_4)_{3(\text{aq})} \longrightarrow 2\text{AlCl}_{3(\text{aq})} + 3\text{BaSO}_{4(\text{s})}\downarrow$$

Barium Aluminium chloride sulphate
Aluminium Barium chloride sulphate
- $$2\text{Na}_{(\text{s})} + 2\text{H}_2\text{O}_{(\text{l})} \longrightarrow 2\text{NaOH}_{(\text{aq})} + \text{H}_{2(\text{g})}$$

Sodium Water Sodium Hydrogen hydroxide

#4. Write the balanced chemical equations for the following reactions:

- Sodium carbonate on reaction with hydrochloric acid in equal molar concentrations gives sodium chloride and sodium hydrogencarbonate.
- Sodium hydrogencarbonate on reaction with hydrochloric acid gives sodium chloride, water and liberates carbon dioxide.
- Copper sulphate on treatment with potassium iodide precipitates cuprous iodide (Cu_2I_2), liberates iodine gas and also forms potassium sulphate.

Ans:

- $$\text{Na}_2\text{CO}_{3(\text{aq})} + \text{HCl}_{(\text{aq})} \longrightarrow \text{NaCl}_{(\text{aq})} + \text{NaHCO}_{3(\text{aq})}$$

Sodium Hydrochloric Sodium Sodium carbonate acid chloride hydrogen carbonate
- $$\text{NaHCO}_{3(\text{aq})} + \text{HCl}_{(\text{aq})} \longrightarrow \text{NaCl}_{(\text{aq})} + \text{H}_2\text{O}_{(\text{l})} + \text{CO}_{2(\text{g})}\uparrow$$

Sodium Hydrochloric Sodium Water Carbon hydrogen acid chloride dioxide carbonate
- $$2\text{CuSO}_{4(\text{aq})} + 4\text{KI}_{(\text{aq})} \longrightarrow \text{Cu}_2\text{I}_{2(\text{s})}\downarrow + 2\text{K}_2\text{SO}_{4(\text{aq})} + \text{I}_{2(\text{g})}\uparrow$$

Copper Potassium Cuprous Potassium Iodine sulphate iodide iodide sulphate

#5. Complete the missing components/variables given as x and y in the following reactions:

- $$\text{Pb}(\text{NO}_3)_{2(\text{aq})} + 2\text{KI}_{(\text{aq})} \longrightarrow \text{PbI}_{2(\text{x})} + 2\text{KNO}_{3(\text{y})}$$
 - $$\text{Cu}_{(\text{s})} + 2\text{AgNO}_{3(\text{aq})} \longrightarrow \text{Cu}(\text{NO}_3)_{2(\text{aq})} + \text{x}_{(\text{s})}$$
 - $$\text{Zn}_{(\text{s})} + \text{H}_2\text{SO}_{4(\text{aq})} \longrightarrow \text{ZnSO}_{4(\text{x})} + \text{H}_{2(\text{y})}$$
 - $$\text{CaCO}_{3(\text{s})} \xrightarrow{\text{x}} \text{CaO}_{(\text{s})} + \text{CO}_{2(\text{g})}$$
- Ans:
- $$\text{x} \rightarrow (\text{s}); \text{y} \rightarrow (\text{aq})$$

$$\text{Pb}(\text{NO}_3)_{2(\text{aq})} + 2\text{KI}_{(\text{aq})} \longrightarrow \text{PbI}_{2(\text{s})} + 2\text{KNO}_{3(\text{aq})}$$
 - $$\text{x} \rightarrow 2\text{Ag}$$

$$\text{Cu}_{(\text{s})} + 2\text{AgNO}_{3(\text{aq})} \longrightarrow \text{Cu}(\text{NO}_3)_{2(\text{aq})} + 2\text{Ag}_{(\text{s})}$$
 - $$\text{x} \rightarrow (\text{aq}); \text{y} \rightarrow (\text{g})$$

$$\text{Zn}_{(\text{s})} + \text{H}_2\text{SO}_{4(\text{aq})} \longrightarrow \text{ZnSO}_{4(\text{aq})} + \text{H}_{2(\text{g})}$$
 - $$\text{x} \rightarrow \text{Heat}$$

$$\text{CaCO}_{3(\text{s})} \xrightarrow{\text{Heat}} \text{CaO}_{(\text{s})} + \text{CO}_{2(\text{g})}$$

Long Answer Questions

[5 Marks]

*1. Translate the following statements into chemical equations and then balance them.

- Hydrogen gas combines with nitrogen to form ammonia.
- Hydrogen sulphide gas burns in air to give water and sulphur dioxide.
- Barium chloride reacts with aluminium sulphate to give aluminium chloride and a precipitate of barium sulphate. [CBSE 2012]
- Potassium metal reacts with water to give potassium hydroxide and hydrogen gas. [CBSE 2012]

Ans:

- $$3\text{H}_{2(\text{g})} + \text{N}_{2(\text{g})} \longrightarrow 2\text{NH}_{3(\text{g})}$$

Hydrogen Nitrogen Ammonia
- $$2\text{H}_2\text{S}_{(\text{g})} + 3\text{O}_{2(\text{g})} \longrightarrow 2\text{H}_2\text{O}_{(\text{l})} + 2\text{SO}_{2(\text{g})}$$

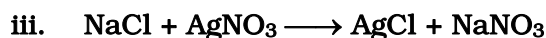
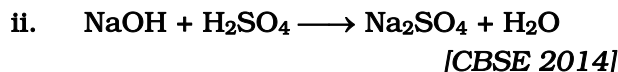
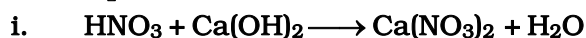
Hydrogen Sulphide Oxygen Water Sulphur dioxide
- $$3\text{BaCl}_{2(\text{aq})} + \text{Al}_2(\text{SO}_4)_{3(\text{aq})} \longrightarrow 2\text{AlCl}_{3(\text{aq})} + 3\text{BaSO}_{4(\text{s})}\downarrow$$

Barium Aluminium chloride sulphate
Aluminium Barium chloride sulphate
- $$2\text{K}_{(\text{s})} + 2\text{H}_2\text{O}_{(\text{l})} \longrightarrow 2\text{KOH}_{(\text{aq})} + \text{H}_{2(\text{g})}$$

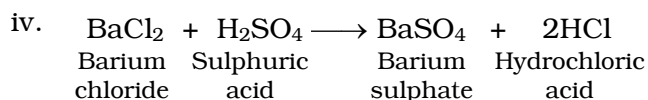
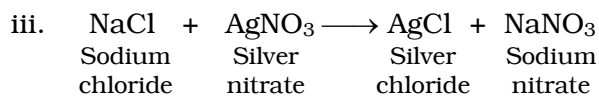
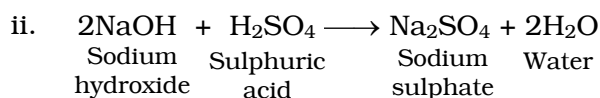
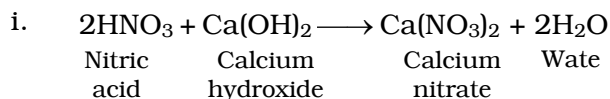
Potassium Water Potassium Hydrogen hydroxide



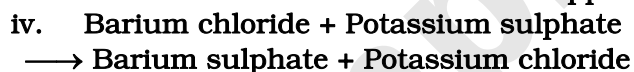
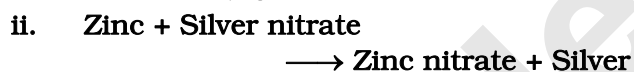
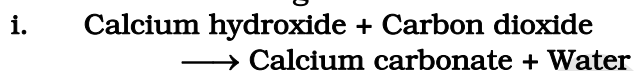
*2. Balance the following chemical equations.



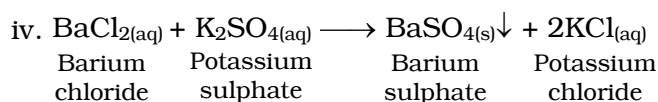
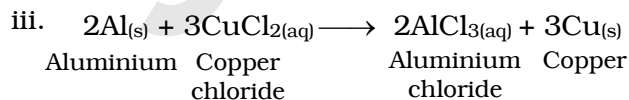
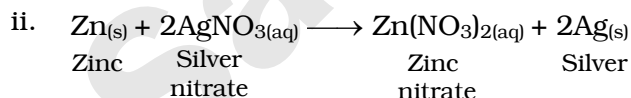
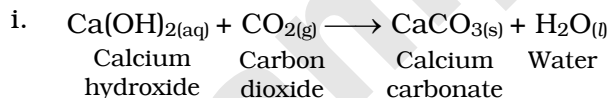
Ans:



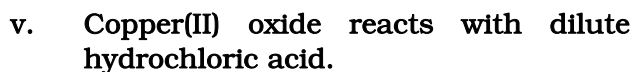
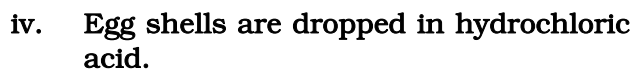
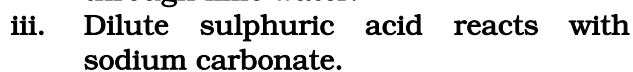
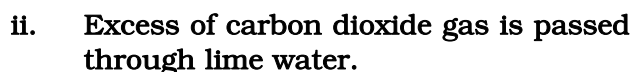
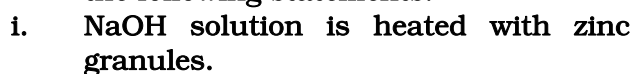
*3. Write the balanced chemical equations for the following reactions:



Ans:

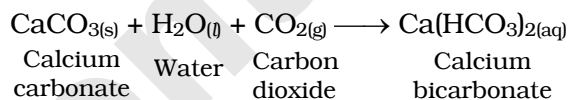
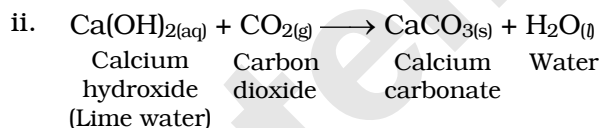
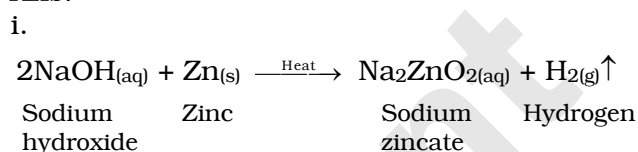


4. Write balanced chemical equations for the following statements.

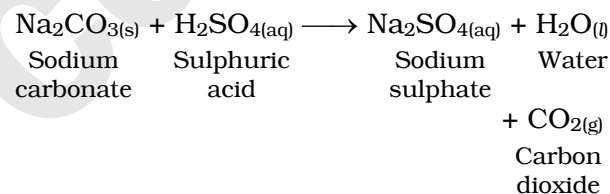


[CBSE 2014]

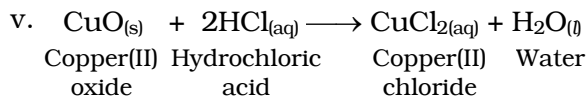
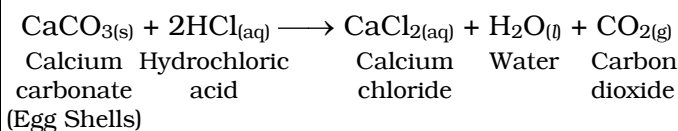
Ans:



iii.

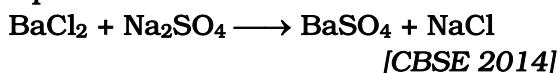


iv.



Practice Questions

1. Balance the following chemical equation:



Ans: Refer 1.1 Very Short Answer Questions Q.6.(i)

2. Write balanced chemical equations for the reaction: Sodium metal reacts with water to form sodium hydroxide and hydrogen gas.
[CBSE 2012]

Ans: Refer 1.1 Short Answer Questions Q.3.(iii).



3. Write balanced chemical equations for the reaction: Dilute hydrochloric acid reacts with sodium carbonate.

[CBSE 2013]

Ans: Refer 1.1 Short Answer Questions Q.4.(i).

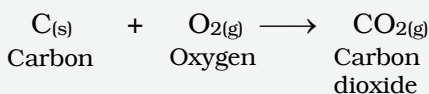
1.2 Types of chemical reactions

- Classification of chemical reactions based on chemical change:

i. Combination reaction:

In this reaction, two or more reactants combine to form a single product.

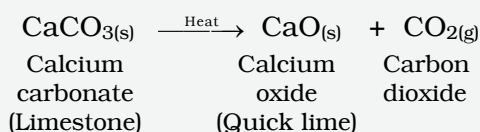
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ii. Decomposition reaction:

In this reaction, single reactant breaks down to form two or more simpler products.

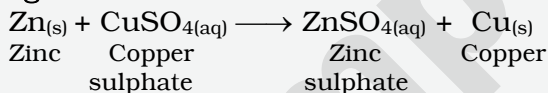
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iii. Displacement reaction:

In this reaction, more reactive element displaces less reactive element from its compound.

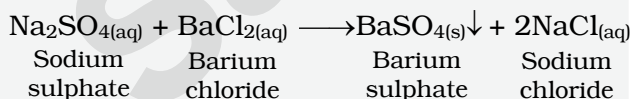
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iv. Double displacement reaction:

In this reaction, there is an exchange of ions between the reactants.

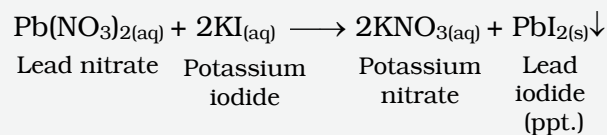
eg.



v. Precipitation reaction:

The reaction which involves formation of precipitate (insoluble substance) is known as precipitation reaction.

eg.



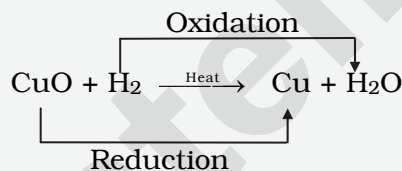
vi. Oxidation-reduction reaction (Redox reaction):

Oxidation is the process in which a substance gains oxygen or loses hydrogen. Reduction is the process in which a substance gains hydrogen or loses oxygen.

The reaction in which one reactant gets oxidised and the other reactant or the same reactant gets reduced is called as oxidation-reduction reaction or redox reaction.

Oxidation and reduction reactions always occur simultaneously.

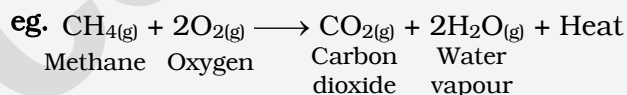
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- Classification of chemical reactions based on energy change:

i. Exothermic reactions:

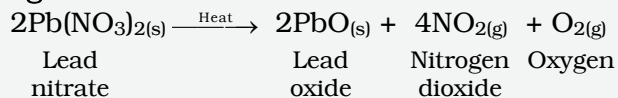
Reactions accompanied by evolution of heat are called exothermic reactions.



ii. Endothermic reactions:

Reactions in which energy is absorbed are called endothermic reactions.

eg.

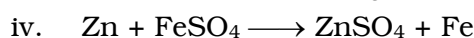
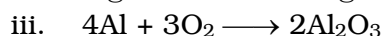
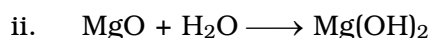
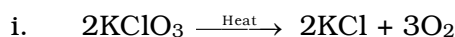


Objective Questions

Multiple Choice Questions

[1 Mark]

- ¶ 1. Which of the following are combination reactions?



(A) i and iii (B) iii and iv

(C) ii and iv (D) ii and iii

Hint: The reaction in which two or more reactants combine to form a single product is called combination reaction. Amongst given options, only in option ii and iii, a single product is formed. Thus, these represent combination reactions.



2. Marble is most commonly used for kitchen countertops. Marble contains _____.

- (A) calcium hydroxide
- (B) calcium chloride
- (C) **calcium carbonate**
- (D) calcium oxide

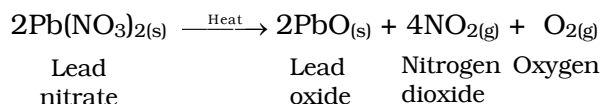
Hint: Marble contains calcium carbonate and its chemical formula is CaCO_3 .

3. When lead nitrate powder is heated in a boiling tube, we observe:

[CBSE 2021-22]

- (A) **Brown fumes of nitrogen dioxide**
- (B) Brown fumes of lead oxide
- (C) Yellow fumes of nitrogen dioxide
- (D) Brown fumes of nitric oxide

Hint: On heating lead nitrate, it decomposes to form lead oxide, oxygen gas and brown coloured nitrogen dioxide gas.



4. Which among the following statement(s) is (are) true? Exposure of silver chloride to sunlight for a long duration turns it grey due to

- i. the formation of silver by decomposition of silver chloride
 - ii. sublimation of silver chloride
 - iii. decomposition of chlorine gas from silver chloride
 - iv. oxidation of silver chloride
- (A) **i only**
 - (B) i and iii
 - (C) ii and iii
 - (D) iv only

5. A chemist carries out electrolysis of water experiment in his laboratory. Which of the following figure correctly shows the volume of the gases collected in the two test tubes?

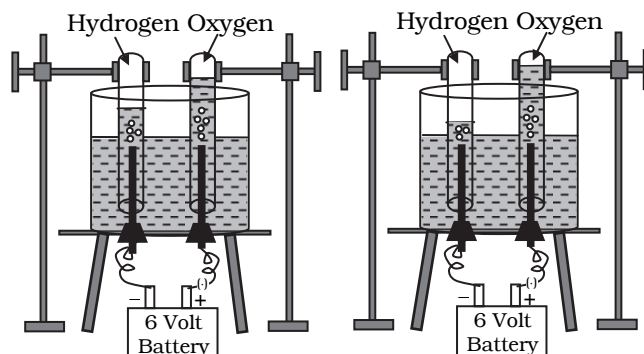
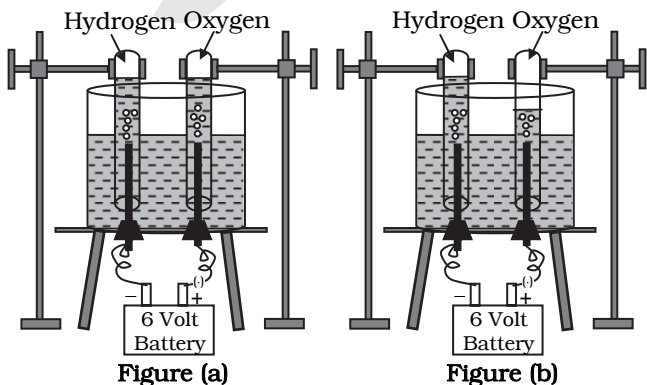


Figure (c)

Figure (d)

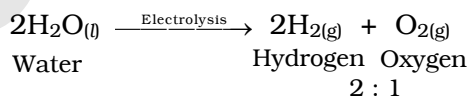
- (A) Figure (a)
- (B) Figure (b)
- (C) **Figure (c)**
- (D) Figure (d)

Hint: During electrolysis of water, the ratio of volume of hydrogen and oxygen formed is 2 : 1.

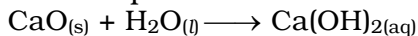
6. Electrolysis of water is a decomposition reaction. The mole ratio of hydrogen and oxygen gases liberated during electrolysis of water is _____.

- (A) 1 : 1
- (B) **2 : 1**
- (C) 4 : 1
- (D) 1 : 2

Hint: During electrolysis of water, hydrogen and oxygen gases are formed in the mole ratio 2 : 1.



7. Calcium oxide reacts vigorously with water to produce slaked lime.



This reaction can be classified as _____.

- i. combination
 - ii. exothermic
 - iii. endothermic
 - iv. oxidation
- (A) i and iii
 - (B) iii and iv
 - (C) i, iii and iv
 - (D) **i and ii**

8. Which of the following is an example of endothermic process? [CBSE 2023]

- (A) Formation of slaked lime
- (B) Decomposition of vegetable into compost
- (C) **Dissolution of ammonium chloride in water**
- (D) Digestion of food in our body

9. Which of the following are exothermic processes?

- i. Reaction of water with quick lime
 - ii. Dilution of an acid
 - iii. Evaporation of water
 - iv. Sublimation of camphor (crystals)
- (A) **i and ii**
 - (B) ii and iii
 - (C) i and iv
 - (D) iii and iv



Hint: When water reacts with quick lime, calcium hydroxide is formed along with release of heat. Thus, it is an exothermic reaction.

The process of diluting a concentrated acid is a highly exothermic process.

Evaporation of water and sublimation of camphor are examples of endothermic reactions.

- ¶10. Three beakers labelled as A, B and C each containing 25 ml of water were taken. A small amount of NaOH, anhydrous CuSO_4 and NaCl were added to the beakers A, B and C respectively. It was observed that there was an increase in the temperature of the solutions contained in beakers A and B, whereas in case of beaker C, the temperature of the solution falls. Which one of the following statement(s) is (are) correct?
- In beakers A and B, exothermic process has occurred.
 - In beakers A and B, endothermic process has occurred.
 - In beaker C, exothermic process has occurred.
 - In beaker C, endothermic process has occurred.
- (A) i only (B) ii only
(C) i and iv (D) ii and iii
- ¶11. Solid calcium oxide reacts vigorously with water to form calcium hydroxide accompanied by liberation of heat. This process is called slaking of lime. Calcium hydroxide dissolves in water to form its solution called lime water. Which among the following is (are) true about slaking of lime and the solution formed?
- It is an endothermic reaction.
 - It is an exothermic reaction.
 - The pH of the resulting solution will be more than seven.
 - The pH of the resulting solution will be less than seven.
- (A) i and ii (B) ii and iii
(C) i and iv (D) iii and iv

Hint: Slaking of lime is accompanied by liberation of heat, hence it is an exothermic reaction.

Calcium hydroxide is an alkali and its aqueous solution (i.e., lime water) turns red litmus blue. Thus, the pH of the solution will be more than seven.



Connections

In Chapter 2, you will study about the pH value of a solution, which indicates its acidic, neutral or alkaline nature.

- ¶12. Which of the following is(are) an endothermic process(es)?
- Dilution of sulphuric acid
 - Sublimation of dry ice
 - Condensation of water vapours
 - Evaporation of water
- (A) i and iii (B) ii only
(C) iii only (D) ii and iv
13. Which of the following reactions is an endothermic reaction?
- Burning of natural gas.
 - Decomposition of vegetable matter into compost.
 - Process of respiration.
 - Decomposition of calcium carbonate to form quick lime and carbon dioxide.**
- ¶14. The following reaction is used for the preparation of oxygen gas in the laboratory
- $$2\text{KClO}_3(\text{s}) \xrightarrow[\text{catalyst}]{\text{Heat}} 2\text{KCl}(\text{s}) + 3\text{O}_2(\text{g})$$
- Which of the following statement(s) is (are) correct about the reaction?
- It is a decomposition reaction and endothermic in nature.**
 - It is a combination reaction.
 - It is a decomposition reaction and accompanied by release of heat.
 - It is a photochemical decomposition reaction and exothermic in nature.
- *15. $\text{Fe}_2\text{O}_3 + 2\text{Al} \longrightarrow \text{Al}_2\text{O}_3 + 2\text{Fe}$
The above reaction is an example of a _____.
- combination reaction
 - double displacement reaction
 - decomposition reaction
 - displacement reaction**
- *16. What happens when dilute hydrochloric acid is added to iron fillings? Choose the correct answer.
- Hydrogen gas and iron chloride are produced.**
 - Chlorine gas and iron hydroxide are produced.
 - No reaction takes place.
 - Iron salt and water are produced.

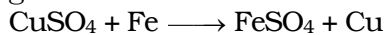


17. The colour of the solution observed after 30 minutes of placing zinc metal to copper sulphate solution is

[CBSE SQP 2023-24]

- (A) Blue
(B) Colourless
(C) Dirty green
(D) Reddish Brown

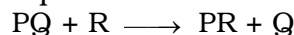
18. Select the correct matching in the following table in connection with the given chemical reaction:



[CBSE 2021-22]

	Initial colour of solution	Final colour of solution	Final colour of iron nail	Type of reaction
(A)	Pale green	Blue	Grey	Displacement
(B)	Blue	Pale green	Brownish	Double displacement
(C)	Blue	Light blue	Grey	Double displacement
(D)	Blue	Pale green	Brownish	Displacement

19. A single displacement reaction is represented below.



Which of the following is TRUE about the reactants and products?

[CBSE APQ 2023-24]

	Type of ion of R in product	Stability of PR as compared to PQ
(A)	cation	more stable
(B)	cation	less stable
(C)	anion	more stable
(D)	anion	less stable

Hint: $\text{P}^+\text{Q}^- + \text{R} \longrightarrow \text{P}^+\text{R}^- + \text{Q}$

In this reaction, element R displaces element Q and forms anion in the product. Element R is more reactive than element Q and the product PR is more stable as compared to PQ.

20. In a double displacement reaction such as reaction between sodium sulphate solution and barium chloride solution, _____.

[CBSE 2020]

- i. exchange of atoms take place
ii. exchange of ions takes place
iii. a precipitate is formed
iv. an insoluble salt is produced
(A) ii and iv (B) i and iii
(C) ii only (D) ii, iii and iv

21. On mixing aqueous solutions of silver nitrate and sodium chloride, a white precipitate is obtained. This reaction can be categorized as _____ reaction.

- (A) decomposition
(B) combination
(C) double displacement
(D) displacement

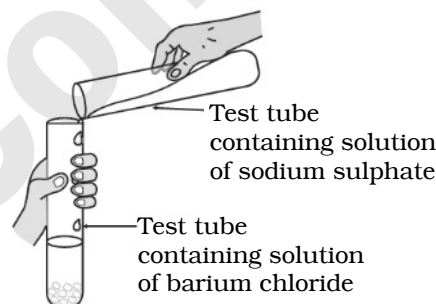
22. When hydrogen sulphide gas is passed through a blue solution of copper sulphate, a black precipitate of copper sulphide is obtained and sulphuric acid formed remains in the solution. The reaction is an example of _____.

[CBSE 2020]

- (A) combination reaction
(B) double displacement reaction
(C) decomposition reaction
(D) displacement reaction

Hint: $\text{CuSO}_4 + \text{H}_2\text{S} \longrightarrow \text{H}_2\text{SO}_4 + \text{CuS}$

- 23.



Identify the product which represents the solid state in the above reaction.

[CBSE SQP 2023-24]

- (A) Barium chloride
(B) Barium sulphate
(C) Sodium chloride
(D) Sodium sulphate

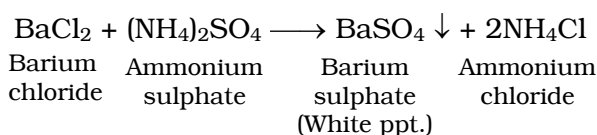
24. Which among the following is (are) double displacement reaction(s)?
(i) $\text{Pb} + \text{CuCl}_2 \longrightarrow \text{PbCl}_2 + \text{Cu}$
(ii) $\text{Na}_2\text{SO}_4 + \text{BaCl}_2 \longrightarrow \text{BaSO}_4 + 2\text{NaCl}$
(iii) $\text{C} + \text{O}_2 \longrightarrow \text{CO}_2$
(iv) $\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
(A) (i) and (iv) (B) (ii) only
(C) (i) and (ii) (D) (iii) and (iv)

25. Barium chloride on reacting with ammonium sulphate forms barium sulphate and ammonium chloride. Which of the following correctly represents the type of the reaction involved?
i. Displacement reaction
ii. Precipitation reaction



- iii. Combination reaction
 iv. Double displacement reaction
 (A) i only (B) ii only
 (C) iv only (D) **ii and iv**

Hint:

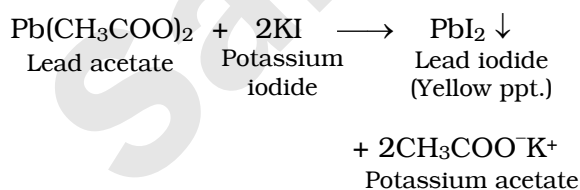


In the given reaction, there is exchange of ions between the reactants, thus it is a double displacement reaction.

Also, white precipitate of barium sulphate is formed as a product, thus it is also an example of precipitation reaction.

26. In the double displacement reaction between aqueous potassium iodide and aqueous lead nitrate, a yellow precipitate of lead iodide is formed. While performing the activity if lead nitrate is not available, which of the following can be used in place of lead nitrate?
- (A) Lead sulphate (insoluble)
 (B) **Lead acetate**
 (C) Ammonium nitrate
 (D) Potassium sulphate

Hint: In order to obtain yellow precipitate of lead iodide, the salt that needs to be used (instead of lead nitrate) should also contain lead. Thus, option (C) and (D) are ruled out. Lead sulphate being an insoluble salt cannot be used for the given activity. Thus, lead acetate which is a soluble salt in water can be used in the given activity.



27. The following reaction is an example of a _____.
- $$4\text{NH}_3(\text{g}) + 5\text{O}_2(\text{g}) \longrightarrow 4\text{NO}(\text{g}) + 6\text{H}_2\text{O}(\text{g})$$
- i. displacement reaction
 ii. combination reaction
 iii. redox reaction
 iv. neutralisation reaction
 (A) i and iv (B) ii and iii
 (C) **i and iii** (D) iii and iv

Hint: The given reaction is a displacement reaction as hydrogen (H) in NH_3 is displaced by oxygen (O). It is also an example of redox reaction as oxidation and reduction reactions occur simultaneously.

28. Some types of chemical reactions are listed below.
- decomposition
 - combination
 - displacement
 - double displacement
- Which two of the following chemical reactions are of the SAME type?
- (P) $\text{AgNO}_3 + \text{NaCl} \longrightarrow \text{AgCl} + \text{NaNO}_3$
 (Q) $\text{Mg} + 2\text{HCl} \longrightarrow \text{MgCl}_2 + \text{H}_2$
 (R) $\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O}$
 (S) $2\text{KOH} + \text{H}_2\text{SO}_4 \longrightarrow \text{K}_2\text{SO}_4 + \text{H}_2\text{O}$
[CBSE APQ 2023-24]
- (A) P and Q
 (B) Q and R
 (C) R and S
 (D) **P and S**

Hint: Both the reactions P and S are double displacement reactions.

29. Which of the following is an example of simple displacement?
- [CBSE Competency Focused Practice Questions 2022-23]*
- (A) the electrolysis of water
 (B) the burning of methane
 (C) **the reaction of a metal with an acid**
 (D) the reaction of two salt solutions to form a precipitate
30. Which among the following are redox reactions?
- i. $\text{CuO} + \text{H}_2 \xrightarrow{\text{Heat}} \text{Cu} + \text{H}_2\text{O}$
 ii. $\text{MgH}_2 \longrightarrow \text{Mg} + \text{H}_2$
 iii. $2\text{Cu} + \text{O}_2 \xrightarrow{\text{Heat}} 2\text{CuO}$
 iv. $\text{ZnO} + \text{C} \longrightarrow \text{Zn} + \text{CO}$
 (A) i, ii and iii (B) i, iii and iv
 (C) ii and iii (D) **i and iv**

31. Which of the following statements about the given reaction are correct?
- $$3\text{Fe}(\text{s}) + 4\text{H}_2\text{O}(\text{g}) \longrightarrow \text{Fe}_3\text{O}_4(\text{s}) + 4\text{H}_2(\text{g})$$
- i. Iron metal is getting oxidised.
 ii. Water is getting reduced.

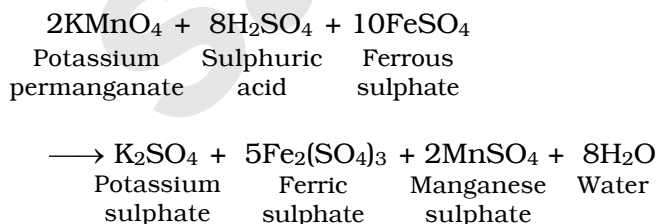


- iii. Water is acting as a reducing agent.
 iv. Water is acting as an oxidising agent.
 (A) i, ii and iii (B) iii and iv
 (C) i, ii and iv (D) ii and iv

Hint: In the given reaction, there is addition of oxygen to iron metal and it is oxidised. Also, there is removal of hydrogen from the water and thus, water is reduced. A substance which causes oxidation of other chemical species in a chemical reaction and itself undergoes reduction is known as an oxidising agent. Thus, in given reaction, water is acting as an oxidising agent.

30. A dilute ferrous sulphate solution was gradually added to the beaker containing acidified potassium permanganate solution. The light purple colour of the solution faded and finally disappeared. Which of the following is the correct explanation for the observation?
 (A) KMnO_4 is an oxidising agent, it oxidises FeSO_4 .
 (B) FeSO_4 acts as an oxidising agent and oxidises KMnO_4 .
 (C) The colour disappears due to dilution; no reaction is involved.
 (D) KMnO_4 is an unstable compound and decomposes in presence of FeSO_4 to a colourless compound.

Hint: Potassium permanganate (KMnO_4) in presence of dil. H_2SO_4 , i.e., in acidic medium acts as strong oxidising agent. In acidic medium, KMnO_4 oxidises ferrous sulphate to ferric sulphate.



- *31. Which of the statements about the reaction below are incorrect?
 $2\text{PbO}_{(s)} + \text{C}_{(s)} \longrightarrow 2\text{Pb}_{(s)} + \text{CO}_{2(g)}$
 i. Lead is getting reduced.
 ii. Carbon dioxide is getting oxidised.
 iii. Carbon is getting oxidised.

- iv. Lead oxide is getting reduced.
 (A) i and ii (B) i and iii
 (C) i, ii and iii (D) all

32. In the redox reaction,
 $\text{MnO}_2 + 4\text{HCl} \longrightarrow \text{MnCl}_2 + 2\text{H}_2\text{O} + \text{Cl}_2$
[CBSE SQP 2022-23]
 (A) MnO_2 is reduced to MnCl_2 & HCl is oxidized to H_2O
 (B) MnO_2 is reduced to MnCl_2 & HCl is oxidized to Cl_2
 (C) MnO_2 is oxidized to MnCl_2 & HCl is reduced to Cl_2
 (D) MnO_2 is oxidized to MnCl_2 & HCl is reduced to H_2O

Assertion & Reason [1 Mark]

1. **Assertion:** A whitewashed wall develops a coating of calcium carbonate after a few days.
Reason: Calcium oxide on the wall reacts slowly with carbon dioxide in the air.
 (A) Assertion is True, Reason is True; Reason is a correct explanation for Assertion.
 (B) Assertion is True, reason is True; Reason is not a correct explanation for Assertion.
 (C) **Assertion is True, Reason is False.**
 (D) Assertion is False, Reason is True.

Hint: A solution of slaked lime (calcium hydroxide) is used for whitewashing walls. Calcium hydroxide reacts slowly with the carbon dioxide in air to form a thin layer of calcium carbonate on the walls.

2. **Assertion:**
 $2\text{FeSO}_{4(s)} \xrightarrow{\text{Heat}} \text{Fe}_2\text{O}_{3(s)} + \text{SO}_{2(g)} + \text{SO}_{3(g)}$
 This is an example of decomposition reaction.
Reason: In a decomposition reaction, a single reactant breaks down to give two or more simpler products.
 (A) **Assertion is True, Reason is True; Reason is a correct explanation for Assertion.**
 (B) Assertion is True, Reason is True; Reason is not a correct explanation for Assertion.
 (C) Assertion is True, Reason is False.
 (D) Assertion is False, Reason is True.

Hint: In the given reaction, a single reactant on heating gave three different products, hence it is a decomposition reaction.



3. **Assertion:** Silver bromide decomposition is used in black and white photography.
Reason: Light provides energy for this exothermic reaction.

[CBSE SQP 2022-23]

- (A) Assertion is True, Reason is True; Reason is a correct explanation for Assertion.
(B) Assertion is True, reason is True; Reason is not a correct explanation for Assertion.
(C) **Assertion is True, Reason is False.**
(D) Assertion is False, Reason is True.

Hint: AgBr decomposes to form Ag and Br₂ in the presence of sunlight. This reaction is used in black and white photography. Since the reaction occurs when energy is absorbed in the form of light, it is an endothermic reaction.

4. **Assertion:** When barium chloride is added to sodium sulphate solution, a white precipitate of barium sulphate is formed.

Reason: The type of reaction involved is displacement reaction, since precipitate is formed during the reaction.

- (A) Assertion is True, Reason is True; Reason is a correct explanation for Assertion.
(B) Assertion is True, reason is True; Reason is not a correct explanation for Assertion.
(C) **Assertion is True, Reason is False.**
(D) Assertion is False, Reason is True.

Hint: The white precipitate of BaSO₄ is formed by the reaction of SO₄²⁻ and Ba²⁺ ions. Such reactions in which there is exchange of ions between the reactants are called double displacement reactions. Since, one of the products formed is in the form of precipitate; it can be called as precipitation reaction.

5. **Assertion:** Rusting of Iron is endothermic in nature.

Reason: As the reaction is slow, the release of heat is barely evident.

[CBSE SQP 2023-24]

- (A) Assertion is True, Reason is True; Reason is a correct explanation for Assertion.
(B) Assertion is True, reason is True; Reason is not a correct explanation for Assertion.

(C) Assertion is True, Reason is False.

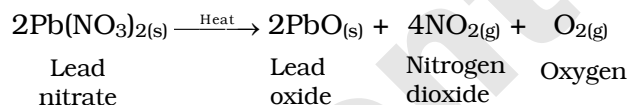
(D) **Assertion is False, Reason is True.**

Subjective Questions

1. Write the reaction for the thermal decomposition of lead nitrate.

[CBSE 2011]

Ans:

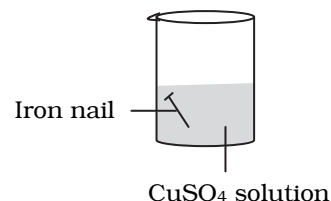


2. Dilip was comparing combination reactions with decomposition reactions. Which class of chemical substances may be the product of a decomposition reaction but NOT a product of a combination reaction?

[CBSE Competency Focused Practice Questions 2022-23]

Ans: Elements can be the product of a decomposition reaction but not a product of a combination reaction.

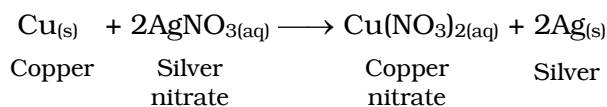
3. What changes in the colour of iron nails and copper sulphate solution do you observe after keeping the iron nails dipped in copper sulphate solution for about 30 minutes?



Ans: Iron nails become reddish brown in colour and copper sulphate solution becomes green in colour.

- *4. In the refining of silver, the recovery of silver from silver nitrate solution involved displacement by copper metal. Write down the reaction involved.

Ans:





#5. Zinc liberates hydrogen gas when reacted with dilute hydrochloric acid, whereas copper does not. Explain why?

Ans: Zinc liberates hydrogen gas when reacted with dilute hydrochloric acid because zinc is more reactive than hydrogen whereas in case of copper, it is less reactive than hydrogen.

#6. Give an example of a double displacement reaction other than the one between barium chloride and sodium sulphate solution.

Ans: $2\text{KBr}_{(\text{aq})} + \text{BaI}_{2(\text{aq})} \longrightarrow 2\text{KI}_{(\text{aq})} + \text{BaBr}_{2(\text{s})}$
 Potassium Bromide Barium iodide Potassium iodide Barium bromide

7. Write the balanced chemical equation of any one reaction that CANNOT be classified as combination, decomposition, simple displacement or double displacement.

[CBSE Competency Focused Practice Questions 2022-23]

Ans: $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \longrightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g}) + \text{Heat}$
 Methane Oxygen Carbon dioxide Water vapour

OR

$\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \longrightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{Heat}$
 Glucose Oxygen Carbon dioxide Water

Very Short Answer Questions [2 Marks]

1. Define combination reaction. Write a balanced chemical equation for a chemical combination reaction.

Ans: i. A reaction in which two or more reactants combine to form a single product is called combination reaction.

ii. $\text{C}_{(\text{s})} + \text{O}_{2(\text{g})} \longrightarrow \text{CO}_{2(\text{g})}$
 Carbon Oxygen Carbon dioxide

#2. A solution of a substance 'X' is used for white washing.

i. Name the substance 'X' and write its formula.
 ii. Write the reaction of the substance 'X' named in (i) above with water.

Ans: i. The given substance 'X' is quick lime or calcium oxide and its formula is CaO.

ii. Quick lime reacts with water to form calcium hydroxide (slaked lime).

$\text{CaO}_{(\text{s})} + \text{H}_2\text{O}_{(\text{l})} \longrightarrow \text{Ca}(\text{OH})_{2(\text{aq})} + \text{Heat}$
 Quick lime 'X' Water Calcium hydroxide (Slaked lime)

GG - Gyan Guru

Airbags....an important safety feature in modern automobiles!!!



Air bags are very important advance in automobile safety.

Air bags which are stored in the auto's steering wheel or dash, are designed to inflate rapidly in the event of accident, cushioning the front-seat occupants against dangerous impact. The bags then deflate immediately to allow vision and movement after the crash. An impact causes a steel ball to compress a spring and electrically ignite a detonator cap of an air bag, which triggers decomposition of sodium azide (NaN_3) forming sodium and nitrogen gas: $2\text{NaN}_3 \longrightarrow 2\text{Na} + 3\text{N}_2$

3. A clear solution of slaked lime is made by dissolving $\text{Ca}(\text{OH})_2$ in an excess of water. This solution is left exposed to air. The solution slowly goes milky as a faint white precipitate forms. Explain why a faint white precipitate forms, support your response with the help of a chemical equation.

[CBSE SQP 2022-23]

Ans: Calcium hydroxide reacts with carbon dioxide in the atmosphere to form calcium carbonate (white precipitate) which turns the clear solution of slaked lime milky.

$\text{Ca}(\text{OH})_{2(\text{aq})} + \text{CO}_{2(\text{g})} \longrightarrow \text{CaCO}_{3(\text{s})} + \text{H}_2\text{O}_{(\text{l})}$
 Calcium hydroxide Carbon dioxide Calcium carbonate Water

4. i. Complete the following chemical equation and balance it.

$\text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2 \longrightarrow$

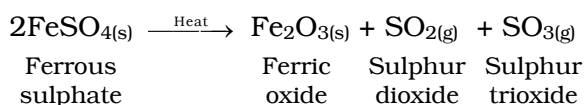
ii. Which two gases are evolved on heating ferrous sulphate crystals?



Ans:

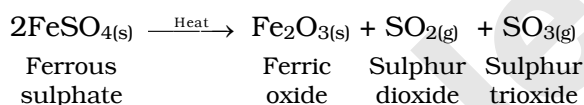
- $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + \text{Heat}$
Glucose Oxygen Carbon dioxide Water
 - Sulphur dioxide (SO_2) and sulphur trioxide (SO_3) gases are evolved on heating ferrous sulphate crystals.
5. What is the colour of ferrous sulphate crystals? How does this colour change after heating? Explain with chemical reaction.

Ans: The colour of ferrous sulphate crystals is green. The colour changes to brown black on heating due to formation of iron oxide.



- ¶6. Ferrous sulphate decomposes with the evolution of gas having a characteristic odour of burning sulphur. Write the chemical reaction involved and also identify the type of chemical reaction.

Ans:



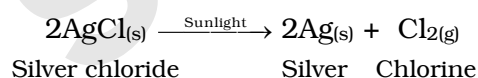
It is a thermal decomposition reaction.

- ¶7. Why do we store silver chloride in dark coloured bottles?

Ans:

- When silver chloride is stored in transparent bottle, it comes directly in contact with light.

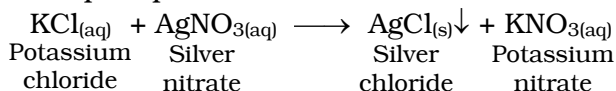
This triggers the decomposition reaction as follows:



- To avoid the decomposition of silver chloride, it is stored in dark coloured bottles.

- ¶8. A solution of potassium chloride when mixed with silver nitrate solution, an insoluble white substance is formed. Write the chemical reaction involved and also mention the type of the chemical reaction.

Ans: When solution of potassium chloride reacts with silver nitrate solution, it forms potassium nitrate and a white precipitate of silver chloride.



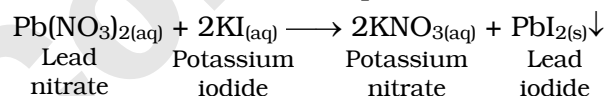
It is a double displacement reaction as well as a precipitation reaction.

9. What is observed when aqueous solutions of potassium iodide and lead nitrate are mixed together? Name the type of reaction and write the chemical equation for the reaction that occurs.

[CBSE 2023]

Ans:

- When aqueous solution of potassium iodide and lead nitrate are mixed together, a yellow precipitate of lead iodide is formed.
- It is a double displacement reaction. Balanced chemical equation:



10. Trupti mixes an aqueous solution of sodium sulphate (Na_2SO_4) and an aqueous solution of copper chloride ($CuCl_2$),

Will this lead to a double displacement reaction? Justify your answer.

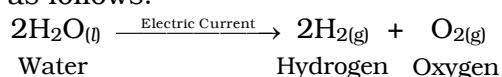
[CBSE Competency Focused Practice Questions 2022-23]

Ans:

- This will not lead to a double displacement reaction.
- When an aqueous solution of sodium sulphate and an aqueous solution of copper chloride is mixed, all the ions (Na^+ , SO_4^{2-} , Cu^{2+} , Cl^-) will be in the solution. These ions do not react to form a precipitate on mixing the two solutions.

- ¶11. Why is the amount of gas collected in one of the test tube double of the amount collected in the other in electrolysis of water experiment? Name this gas.

Ans: The reaction for electrolysis of water is as follows:





Thus, water decomposes to give hydrogen and oxygen in the ratio of 2 : 1 by volume. Hydrogen gas is present in one of the test tube which is of double volume than the other gas.

¶12. Which amongst the following changes are exothermic or endothermic in nature?

- i. Decomposition of ferrous sulphate
- ii. Dilution of sulphuric acid
- iii. Dissolution of sodium hydroxide in water
- iv. Dissolution of ammonium chloride in water

Ans:

- | | |
|-----------------|-----------------|
| i. Endothermic | ii. Exothermic |
| iii. Exothermic | iv. Endothermic |



Reading between the lines

- i. For decomposition of ferrous sulphate heat has to be continuously supplied from outside; hence, this process is endothermic.
- ii. In the process of dilution of sulphuric acid with water, very large amount of heat is liberated; hence, this process is highly exothermic.
- iii. When NaOH is dissolved in water, there is evolution of heat (i.e., exothermic process).
- iv. When NH₄Cl is dissolved in water, there is absorption of heat (i.e., endothermic process).

13. Identify the type of each of the following reactions:

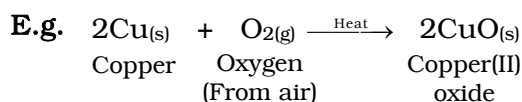
- i. A reaction in which a single product is formed from two or more reactants.
- ii. The reaction mixture becomes warm.
- iii. An insoluble substance is formed.
- iv. External surface of the container in which reaction takes place becomes freezing cold. [CBSE 2012]

Ans:

- i. Combination reaction
- ii. Exothermic reaction
- iii. Precipitation reaction
- iv. Endothermic reaction

14. What is oxidation reaction? Give an example.

Ans: Oxidation reaction is a chemical reaction in which substance gains oxygen or loses hydrogen.



GG - Gyan Guru

Can eating chocolate and candy slow down the ageing process?



Oxidation is only one possible cause for ageing. Researchers have found that chocolate and candy (with higher cacao content) eaters live about a year longer than those who don't. The antioxidants present in chocolate and candy retard oxidation. Chocolate contains phenol-antioxidants which promote good health and slow down the ageing process.

15. What is an oxidising agent? What is a reducing agent?

Ans:

- i. An oxidising agent is a substance which gains hydrogen or loses oxygen during a chemical reaction.
- ii. A reducing agent is a substance which gains oxygen or loses hydrogen during a chemical reaction.

¶16. Identify the reducing agent in the following reactions:

- i. $4\text{NH}_3 + 5\text{O}_2 \longrightarrow 4\text{NO} + 6\text{H}_2\text{O}$
- ii. $\text{H}_2\text{O} + \text{F}_2 \longrightarrow \text{HF} + \text{HOF}$
- iii. $\text{Fe}_2\text{O}_3 + 3\text{CO} \longrightarrow 2\text{Fe} + 3\text{CO}_2$
- iv. $2\text{H}_2 + \text{O}_2 \longrightarrow 2\text{H}_2\text{O}$

Ans:

- | | |
|--------------------|----------------------|
| i. NH ₃ | ii. H ₂ O |
| iii. CO | iv. H ₂ |



Reading between the lines

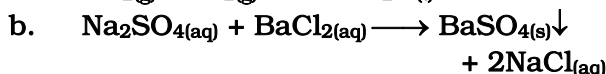
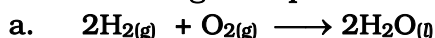
The species, which itself undergoes oxidation and causes reduction of another species is called reducing agent (reductant).

- i. NH₃ gets oxidized to NO.
Thus, NH₃ acts as reducing agent.
- ii. H₂O gets oxidized to HOF.
Hence, H₂O acts as reducing agent.
- iii. CO gets oxidized to CO₂.
Hence, CO acts as reducing agent.
- iv. H₂ gets oxidized to H₂O.
Hence, H₂ acts as reducing agent.

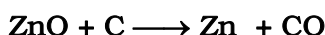


17. Answer the following:

i. Identify the type of reaction in the following examples:



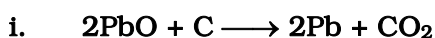
ii. Identify the substance that is oxidised and substance that is reduced in the reaction.



Ans:

- i.
 - a. Combination reaction
 - b. Double displacement or precipitation reaction
- ii. In the given reaction, C is oxidised to CO and ZnO is reduced to Zn.

18.



ii. $\text{MnO}_2 + 4\text{HCl} \longrightarrow \text{MnCl}_2 + 2\text{H}_2\text{O} + \text{Cl}_2$
 What is redox reaction? Identify the substance oxidised and the substance reduced in the above reactions.

[CBSE 2012]

Ans: The reaction in which one reactant gets oxidised and the other reactant gets reduced is called redox reaction.

- i. In first reaction, lead oxide gets reduced and carbon gets oxidised.
- ii. In second reaction, HCl gets oxidised and MnO_2 gets reduced.

GG - Gyan Guru

Batteries – A portable source of electrical energy

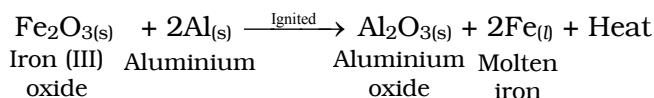
Imagine a world where everything that used electricity had to be plugged in. Thankfully, batteries provide us with a mobile source of power that makes many modern conveniences possible.



While there are many different types of batteries, the basic concept by which they function remains the same. Inside a battery, an electrochemical reaction occurs that produces electrical energy. The reaction involves transfer of electrons and is an oxidation/reduction (redox) reaction.

19. Write the balanced chemical equation for the following reaction and identify the type of reaction and define it. Iron (III) oxide reacts with aluminium and gives molten iron and aluminium oxide. [CBSE 2012]

Ans:



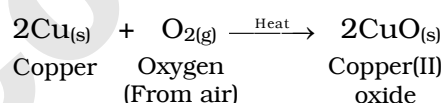
This is a displacement reaction.

A chemical reaction in which more reactive element displaces less reactive element from its compound is called displacement reaction.

*20. A shiny brown coloured element 'X' on heating in air becomes black in colour. Name the element 'X' and black coloured compound formed.

Ans: Element 'X' is copper (Cu).

Black coloured compound formed is copper(II) oxide (CuO).



21. When copper powder is heated in a watch glass, a black substance is formed.

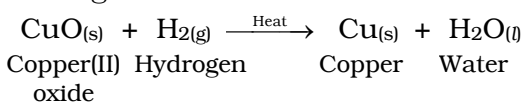
- i. Why is this black substance formed? Name it.
- ii. How can this black substance be reversed to its original form?

[CBSE 2023]

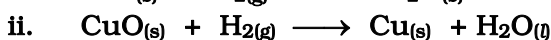
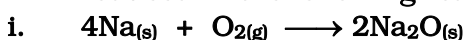
Ans:

i. Black coloured substance is formed because oxidation of copper occurs as result of its reaction with oxygen (in air). The black substance formed is copper(II) oxide.

ii. When hydrogen gas is passed over heated copper(II) oxide, copper is formed back along with water. Thus, the black substance can be reversed to its original form.



#21. Identify the substances that are oxidised and the substances that are reduced in the following reactions:



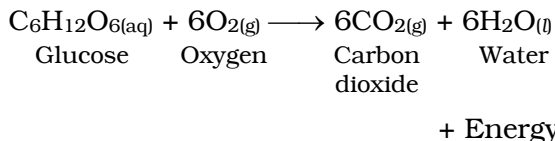


Ans:

- In the given reaction, sodium gets oxidised to sodium oxide (Na_2O) and oxygen gets reduced.
- In the given reaction, hydrogen gets oxidised to water and copper(II) oxide gets reduced to copper metal.

*22. Why is respiration considered an exothermic reaction? Explain.

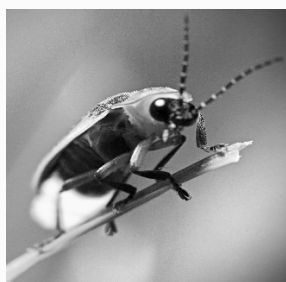
Ans: During respiration, glucose gets oxidised forming carbon dioxide and water.



As the reaction is accompanied by energy liberation, it is said to be an exothermic reaction.

GG - Gyan Guru

Glowing Fireflies...



Fireflies produce light through a process known as bioluminescence. They have specialized cells that contain a chemical compound called luciferin and an enzyme called luciferase.

To make light, luciferin reacts with ATP and oxygen. The enzyme luciferase catalyzes the oxidation of luciferin. When oxygen is available inside the cells, the firefly produces characteristic yellow or green glow. When there is no oxygen, the light goes out.

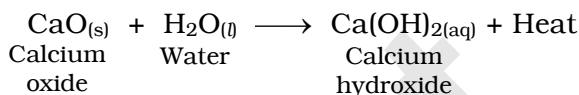
Short Answer Questions

[3 Marks]

- Keerti takes some amount of quick lime in a glass beaker. Then she slowly adds water to it. State two important observations and name the type of reaction taking place when water is added to quick lime. Write chemical equation of the reaction involved.

Ans:

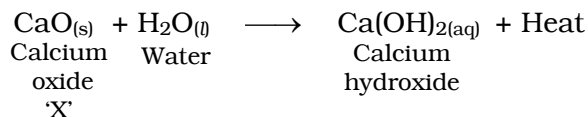
- The observations are as follows:
 - Quick lime reacts vigorously with water producing hissing sound.
 - Beaker becomes hot.
- Quick lime (calcium oxide) reacts with water vigorously to form calcium hydroxide and releases large amount of heat.



It is an example of a combination reaction as well as an exothermic reaction.

‡2. A substance X, which is an oxide of a group 2 element, is used intensively in the cement industry. This element is present in bones also. On treatment with water it forms a solution which turns red litmus blue. Identify X and also write the chemical reactions involved.

Ans: The given substance X is calcium oxide. Calcium oxide is used intensively in the cement industry. The element presents in it (which is present in bones also) is calcium. Calcium oxide on treatment with water forms a solution of calcium hydroxide [$\text{Ca}(\text{OH})_2$] which is an alkali. Hence, it turns red litmus blue.



Connections

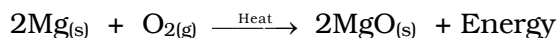
In Chapter 2, you will study how a litmus paper is used to distinguish between acid and base.

- A magnesium ribbon is burnt in oxygen to give white compound X accompanied by emission of light. If the burning ribbon is now placed in an atmosphere of nitrogen, it continues to burn and forms a compound Y.
 - Write the chemical formulae of X and Y.
 - Write a balanced chemical equation, when X is dissolved in water.



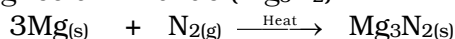
Ans:

- i. When magnesium ribbon is burnt in oxygen, it forms magnesium oxide with emission of light and heat energy.



Magnesium Oxygen Magnesium
oxide 'X'

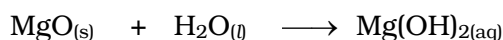
Chemical formula of compound X is MgO.
If the burning ribbon is placed in nitrogen gas chamber, magnesium reacts with nitrogen and forms magnesium nitride (Mg_3N_2).



Magnesium Nitrogen Magnesium
nitride 'Y'

Chemical formula of compound Y is Mg_3N_2 .

- ii. If magnesium oxide is dissolved in water, it forms magnesium hydroxide.



Magnesium Water Magnesium
oxide 'X' hydroxide

4. 2 g of lead nitrate powder is taken in a boiling tube. The boiling tube is heated over a flame. Now answer the following:

- i. State the colour of the fumes evolved and the residue left.
ii. Name the type of chemical reaction that has taken place stating its balanced chemical equation.

[CBSE 2012]

Ans:

- i. Brown coloured fumes of NO_2 gas are evolved and colour of the residue left behind is brown.

- ii. It is a thermal decomposition reaction.

Chemical equation:



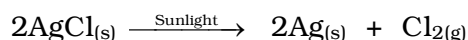
Lead Lead Nitrogen Oxygen
nitrate oxide dioxide

5. Silver chloride kept in a china dish turns grey in sunlight.

- i. Write the colour of silver chloride when it was kept in the china dish.
ii. Name the type of chemical reaction taking place and write the chemical equation for the reaction.
iii. State one use of reaction. Name one more chemical which can be used for the same purpose. [CBSE 2023]

Ans:

- i. The colour of silver chloride when it was kept in the china dish is white.
ii. Type of chemical reaction is decomposition reaction or photochemical decomposition or endothermic reaction.



Silver chloride Silver Chlorine

- iii. The reaction is used in black and white photography.
Another chemical which can be used for the same purpose is silver bromide (AgBr).

Enrich Your Knowledge

- ❖ Silver chloride is used in photography, silver plating and medicine.
- ❖ Decomposition reactions that occur due to presence of light are known as photochemical decomposition reactions.

6. Tina finds a paper covered with a white substance in a chemistry lab. She keeps the paper near the window of the lab and comes back to pick it up after five hours to take it home. She noticed that the white substance had turned grey.

- i. What could be the most likely substance on the paper that Tina found?
ii. The substance changed from white to grey. Write the chemical equation for this reaction.
iii. State ONE application of this property of the substance seen in daily life.

[CBSE Competency Focused
Practice Questions 2022-23]

Ans:

- i. The most likely substance on the paper that Tina found is silver chloride (AgCl) or silver bromide (AgBr).

- ii.
$$2\text{AgCl}_{(s)} \xrightarrow{\text{Sunlight}} 2\text{Ag}_{(s)} + \text{Cl}_{2(g)}$$

Silver chloride Silver Chlorine

OR

- $$2\text{AgBr}_{(s)} \xrightarrow{\text{Sunlight}} 2\text{Ag}_{(s)} + \text{Br}_{2(g)}$$

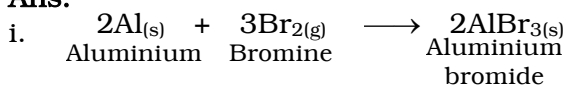
Silver bromide Silver Bromine
iii. Application: AgCl or AgBr is used in black and white photography.



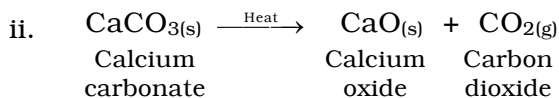
7. Write balanced equations for the following mentioning the type of reaction involved:

- i. Aluminium + Bromine
→ Aluminium bromide
- ii. Calcium carbonate
→ Calcium oxide + Carbon dioxide
- iii. Silver chloride → Silver + Chlorine
[CBSE 2011]

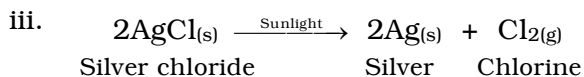
Ans:



It is a combination reaction.



It is a thermal decomposition reaction.



It is a decomposition reaction.

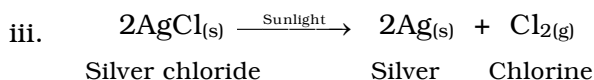
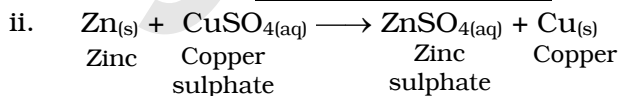
8.

- i. Mention two observations which you will make on heating ferrous sulphate crystals in a boiling tube.
- ii. On placing a zinc plate in copper sulphate solution, it was observed that the zinc plate develops holes after a few days. Give chemical equation to explain this.
- iii. Silver chloride turns grey when exposed to sunlight. Give chemical equation to explain this.

[CBSE 2016]

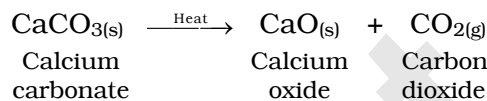
Ans:

i. When ferrous sulphate crystals are heated in a boiling tube, the colour changes to brown black due to formation of iron oxide and the colourless gas is evolved with odour of burnt sulphur.

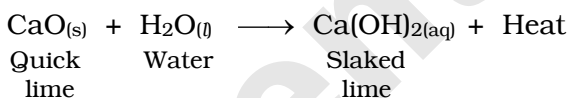


*9. Why are decomposition reactions called the opposite of combination reactions? Write equations for these reactions.

Ans: In decomposition reaction, a single compound breaks down to produce two or more simple substances whereas in combination reaction, two or more simple substances combine to form a new compound. Hence, decomposition reactions are called the opposite of combination reactions. Decomposition reaction:



Combination reaction:



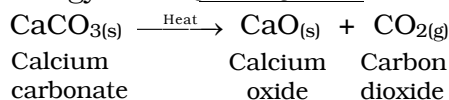
*10. Write one equation each for decomposition reactions where energy is supplied in the form of heat, light or electricity.

OR

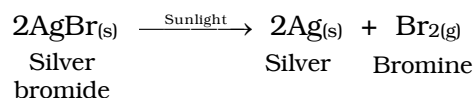
Decomposition reactions require energy in the form of heat or light or electricity for breaking down the reactants. Write one equation each for decomposition reactions where energy is supplied in the form of heat, light and electricity. [CBSE 2018]

Ans:

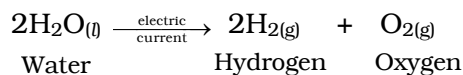
i. Decomposition reaction that requires energy in the form of heat:



ii. Decomposition reaction that requires energy in the form of light:



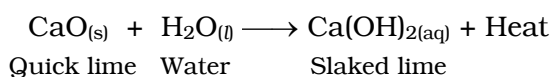
iii. Decomposition reaction that requires energy in the form of electricity:



*11. What does one mean by exothermic and endothermic reactions? Give examples.

Ans: **Exothermic reactions:** Reactions accompanied by evolution of heat are called exothermic reactions.

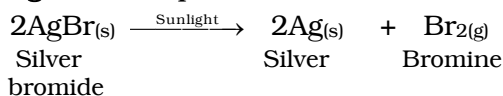
eg.





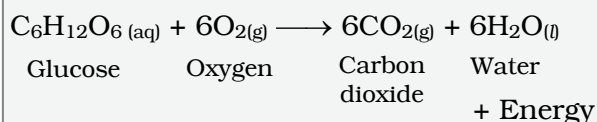
Endothermic reactions: Reactions in which energy is absorbed are called endothermic reactions.

eg. Decomposition of silver bromide:



Enrich Your Knowledge

- ❖ Combustion, the first reaction known to be carried out by humans is a rapid exothermic and redox reaction.
- ❖ During digestion, food is broken down into simpler substances. For example, rice, potatoes and bread contain carbohydrates which are broken down to form glucose. This glucose combines with the oxygen present in the cells of our body. The reaction is exothermic and can be represented as follows:



This reaction has been given a special name as 'Respiration' and the energy liberated during the reaction is used by us to carry out all our activities.

- 12.
- State the main difference between an endothermic reaction and an exothermic reaction.
 - Why is photosynthesis considered as an endothermic reaction?
 - All decomposition reactions are endothermic reactions. Give reason.

Ans:

- In endothermic reaction, energy is absorbed whereas in exothermic reaction, energy is evolved.
- Photosynthesis is an endothermic reaction because it requires energy in the form of sunlight.
- Decomposition reactions require energy (either in the form of heat, light or electricity) for breaking down the reactants. Hence, all decomposition reactions are endothermic.

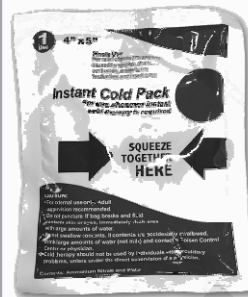
[Note: Students can scan the Q.R. code in Quill - The Padhai App to get conceptual clarity with the aid of a relevant video.]



GG - Gyan Guru

Instant ice packs

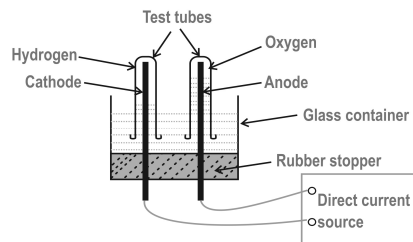
An endothermic reaction occurs when two separate compounds interact to absorb energy in the form of heat.



An instant ice pack contains both water and ammonium nitrate in separate tubes. In order to use the ice pack, these tubes are broken. The breaking of tubes allows water and ammonium nitrate to mix which sets off an endothermic reaction and causes the water to freeze.

The freezing of the water prevents all of the ammonium nitrate from instantaneously mixing with the water. As the ice melts, the water mixes with additional ammonium nitrate, causing additional endothermic reactions and forcing the melted ice to re-freeze. This process allows instant ice packs to remain frozen and maintain extremely low temperatures for an extended period despite being stored or used at room temperature.

13. The diagram below shows the set-up in which electrolysis of water takes place.



- What type of reaction takes place?
- Explain why this is an example of an endothermic reaction?
- The test tube containing hydrogen is removed carefully from the apparatus. A lit match stick is brought near the mouth of this test tube. The gas burns with an explosive "pop" sound. Write a balanced chemical equation for this reaction and indicate whether energy is absorbed or released.

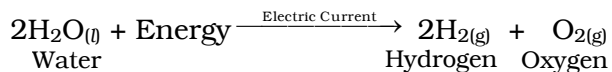
[CBSE Competency Focused Practice Questions 2022-23]

Ans:

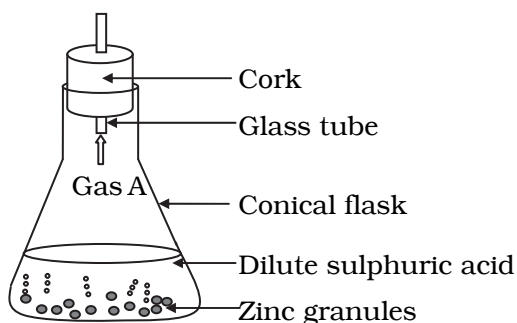
- It is a decomposition reaction or electrolytic decomposition reaction.



- ii. Energy in the form of electrical energy is absorbed during the decomposition of water. Hence, electrolysis of water is an example of an endothermic reaction.
- iii. The balanced chemical equation for the electrolysis of water is as follows:



14. The following diagram shows an experiment to study the action of dilute sulphuric acid on zinc granules.



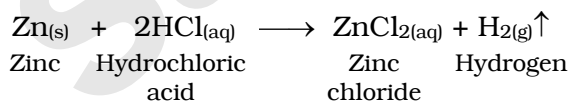
- i. Identify the gas A.
- ii. Write the chemical equation of the reaction that takes place and identify the type of reaction.
- iii. What will happen if dilute hydrochloric acid is used instead of dilute sulphuric acid?

Ans:

- i. The gas A is hydrogen.
- ii. $\text{Zn}_{(s)} + \text{H}_2\text{SO}_{4(aq)} \longrightarrow \text{ZnSO}_{4(aq)} + \text{H}_{2(g)}\uparrow$
 Zinc Sulphuric Zinc Hydrogen
 acid sulphate

It is a displacement reaction.

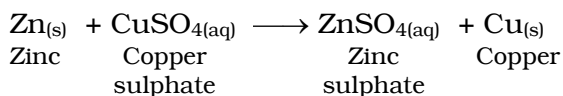
- iii. Zinc will react with dilute hydrochloric acid to form zinc chloride and hydrogen gas.



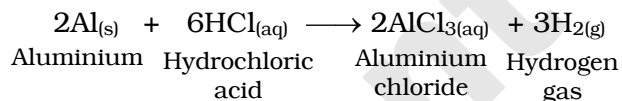
15. What happens when a piece of
- i. zinc metal is added to copper sulphate solution?
 - ii. aluminium metal is added to dilute hydrochloric acid?
 - iii. silver metal is added to copper sulphate solution?
- Also write the balanced chemical equation if the reaction occurs.

Ans:

- i. Zinc metal reacts with copper sulphate solution and forms colourless zinc sulphate and reddish brown copper metal.



- ii. Aluminium metal reacts with dilute hydrochloric acid to form aluminium chloride and hydrogen gas.



- iii. Silver is less reactive than copper. Hence, no reaction will take place.



Connections

In Chapter 3, you will study on reactivity series of metals. From which, you will be able to predict whether the metal will react with the salt solution of another metal.

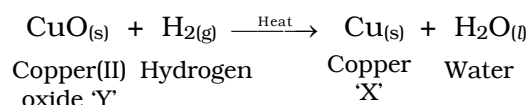
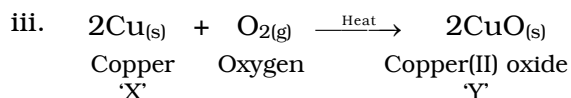
16. A brown substance 'X' on heating in air forms a substance 'Y'. When hydrogen gas is passed over heated 'Y', it again changes back into 'X'.

- i. Name the substance X and Y.
- ii. Name the type of chemical reaction occurring during both the changes.
- iii. Write the chemical equations of the reactions.

[CBSE 2012]

Ans:

- i. X is copper (Cu) and Y is copper(II) oxide (CuO).
- ii. The first reaction is a combination and an oxidation reaction while the second reaction is a redox and a displacement reaction.

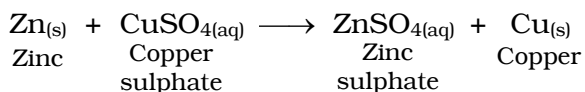


- *17. What is the difference between displacement and double displacement reactions? Write equations for these reactions.



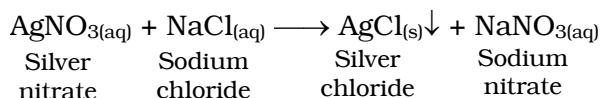
Ans: In displacement reaction, more reactive element displaces less reactive element from its compound.

eg. Zinc is more reactive than copper and hence, it displaces copper from copper sulphate solution.



In double displacement reaction, two compounds exchange their ions and form two new compounds.

eg. Silver nitrate and sodium chloride exchange NO_3^- and Cl^- ions between them to form silver chloride and sodium nitrate.



*18. What do you mean by precipitation reaction? Explain by giving examples.

OR

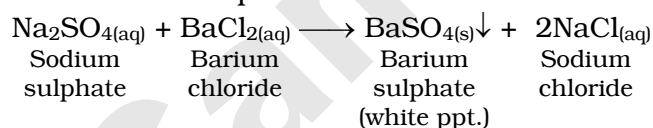
When is a chemical reaction categorised as a precipitation reaction? Explain with two examples.

[CBSE 2011]

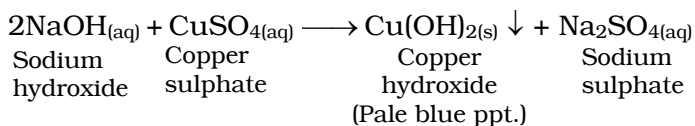
Ans: The reaction in which reactants react to form a product that is insoluble in the reaction mixture is called as precipitation reaction. In other words, any reaction that produces a precipitate can be called a precipitation reaction.

eg.

i. Sodium sulphate reacts with barium chloride to form a white precipitate of barium sulphate.



ii. Sodium hydroxide reacts with copper sulphate to form a pale blue precipitate of copper hydroxide.



*19. On adding a drop of barium chloride solution to an aqueous solution of sodium sulphite, white precipitate is obtained.

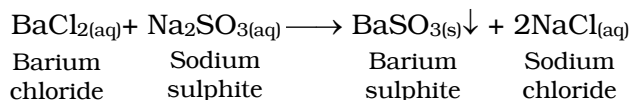
i. Write a balanced chemical equation of the reaction involved.

ii. What other name can be given to this precipitation reaction?

iii. On adding dilute hydrochloric acid to the reaction mixture, white precipitate disappears. Why?

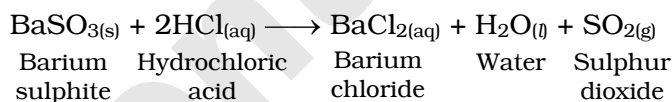
Ans:

i.



ii. This reaction can also be named as double displacement reaction.

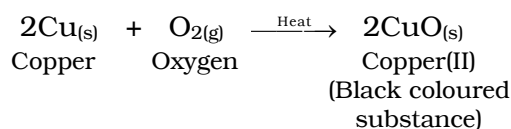
iii. On adding dilute hydrochloric acid (HCl) to the reaction mixture, white precipitate disappears because barium sulphite reacts with excess HCl to form barium chloride and sulphur dioxide. Barium chloride is soluble in water.



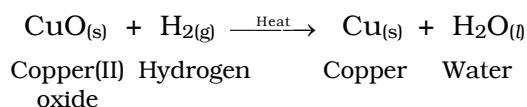
20. 1 g of copper powder is taken in china dish and heated. What change takes place on heating? When hydrogen gas is passed over heated substance, a visible change is seen in it. Give the chemical equations, the name and colour of the products formed in each case. [CBSE 2020]

Ans:

- A chemical change takes place on heating.
- Black coloured substance is formed by the oxidation of copper. Black substance is copper(II) oxide.



iii. When hydrogen gas is passed over heated substance, a brown coloured copper is formed back along with water.



Connections

In Chapter 3, you will study how metals react with oxygen.



21. What is redox reaction? When a magnesium ribbon burns in air with a dazzling flame and forms a white ash, is magnesium oxidised or reduced? Why? [CBSE 2015]

Ans:

- The reaction in which one reactant gets oxidised and the other reactant gets reduced is called redox reaction.
- When a magnesium ribbon burns in air with a dazzling flame and forms a white ash, magnesium gets oxidised to magnesium oxide.
- Here, magnesium is said to be oxidised as it is combining with oxygen.

22.

- Write balanced equation for the reaction between magnesium and hydrochloric acid. Name the products obtained and identify the type of reaction. [CBSE 2012]
- Barium chloride reacts with aluminium sulphate to give aluminium chloride and barium sulphate. State the two types in which the above reaction can be classified. [CBSE 2012]

Ans:

- $$\text{Mg}_{(s)} + \text{Cl}_{2(g)} \longrightarrow \text{MgCl}_{2(s)}$$

Magnesium Chlorine Magnesium chloride
 - The products are magnesium chloride and hydrogen gas.
- The above reaction can be classified as double displacement as well as precipitation reaction.

23. Identify the type of reactions taking place in each of the following cases and write the balanced chemical equation for the reactions.

- Zinc reacts with silver nitrate to produce zinc nitrate and silver.
- Potassium iodide reacts with lead nitrate to produce potassium nitrate and lead iodide.

[CBSE 2019]

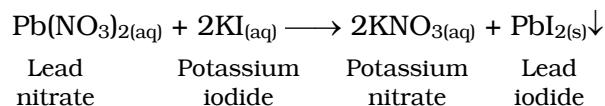
Ans:

- It is a displacement reaction.
Balanced chemical equation:

$$\text{Zn}_{(s)} + 2\text{AgNO}_{3(aq)} \longrightarrow \text{Zn}(\text{NO}_3)_{2(aq)} + 2\text{Ag}_{(s)}$$

Zinc Silver Zinc Silver
nitrate nitrate

- It is a double displacement reaction.
Balanced chemical equation:



24. Select (i) combination reaction (ii) decomposition reaction (iii) displacement reaction and (iv) double displacement reaction from the following chemical equations:

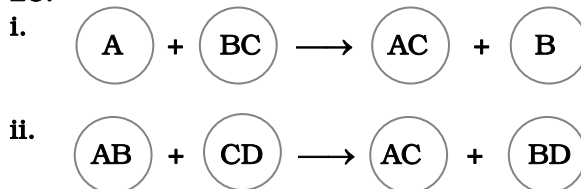
- $\text{ZnCO}_3(s) \longrightarrow \text{ZnO}_{(s)} + \text{CO}_{2(g)}$
- $\text{Pb}_{(s)} + \text{CuCl}_{2(aq)} \longrightarrow \text{PbCl}_{2(aq)} + \text{Cu}_{(s)}$
- $\text{NaBr}_{(aq)} + \text{AgNO}_3(aq) \longrightarrow \text{AgBr}_{(s)} + \text{NaNO}_3(aq)$
- $\text{H}_{2(g)} + \text{Cl}_{2(g)} \longrightarrow 2\text{HCl}_{(g)}$
- $\text{Fe}_2\text{O}_3(s) + 2\text{Al}_{(s)} \longrightarrow \text{Al}_2\text{O}_3(s) + 2\text{Fe}_{(l)}$
- $3\text{H}_2(g) + \text{N}_2(g) \longrightarrow 2\text{NH}_3(g)$

[CBSE 2014]

Ans:

- Decomposition reaction
- Displacement reaction
- Double displacement reaction
- Combination reaction
- Displacement reaction
- Combination reaction

25.



Identify the types of reaction mentioned above in (i) and (ii). Give one example for each type in the form of a balanced chemical equation.

[CBSE SQP 2022-23]

Ans:

- It is a displacement reaction.
Example of displacement reaction:

$$\text{Fe}_{(s)} + \text{CuSO}_{4(aq)} \longrightarrow \text{FeSO}_{4(aq)} + \text{Cu}_{(s)}$$

Iron Copper Ferrous Copper
sulphate sulphate
(Blue colour (Green colour
solution) solution)
- It is a double displacement reaction.
Example of double displacement reaction:

$$\text{Na}_2\text{SO}_4(aq) + \text{BaCl}_2(aq) \longrightarrow \text{BaSO}_4(s) \downarrow + 2\text{NaCl}_{(aq)}$$

Sodium Barium Barium Sodium
sulphate chloride sulphate chloride
(white ppt.)



26. Identify the oxidising agent (oxidant) in the following reactions:

- $\text{Pb}_3\text{O}_4 + 8\text{HCl} \longrightarrow 3\text{PbCl}_2 + \text{Cl}_2 + 4\text{H}_2\text{O}$
- $2\text{Mg} + \text{O}_2 \longrightarrow 2\text{MgO}$
- $\text{CuSO}_4 + \text{Zn} \longrightarrow \text{Cu} + \text{ZnSO}_4$
- $\text{V}_2\text{O}_5 + 5\text{Ca} \longrightarrow 2\text{V} + 5\text{CaO}$
- $3\text{Fe} + 4\text{H}_2\text{O} \longrightarrow \text{Fe}_3\text{O}_4 + 4\text{H}_2$
- $\text{CuO} + \text{H}_2 \longrightarrow \text{Cu} + \text{H}_2\text{O}$

Ans:

- | | | |
|----------------------------|-------------------------|----------------------|
| i. Pb_3O_4 | ii. O_2 | iii. CuSO_4 |
| iv. V_2O_5 | v. H_2O | vi. CuO |



Reading between the lines

The species, which itself undergoes reduction and causes oxidation of another species is called oxidising agent (oxidant).

- Pb_3O_4 is reduced to PbCl_2 (Removal of oxygen). Hence, Pb_3O_4 is the oxidising agent.
- O_2 oxidises Mg to MgO . Hence, O_2 is the oxidising agent.
- CuSO_4 is reduced to Cu (Removal of oxygen). Hence, CuSO_4 is the oxidising agent.
- V_2O_5 is reduced to V (Removal of oxygen). Hence, V_2O_5 is the oxidising agent.
- H_2O is reduced to H_2 (Removal of oxygen). Hence, H_2O is the oxidising agent.
- CuO is reduced to Cu (Removal of oxygen). Hence, CuO is the oxidising agent.

Long Answer Questions

[5 Marks]

- Classify the following reactions into different types:
 - $\text{AgNO}_3(\text{aq}) + \text{NaCl}(\text{aq}) \longrightarrow \text{AgCl}(\text{s}) + \text{NaNO}_3(\text{aq})$
 - $\text{CaO}(\text{s}) + \text{H}_2\text{O}(\text{l}) \longrightarrow \text{Ca}(\text{OH})_2(\text{aq})$
 - $2\text{KClO}_3(\text{s}) \xrightarrow{\Delta} 2\text{KCl}(\text{s}) + 3\text{O}_2(\text{g})$
- Which of the above reaction(s) is/are precipitation reaction(s)? Why is a reaction called precipitation reaction? [CBSE 2011]

Ans:

- Double displacement reaction
 - Combination reaction
 - Thermal decomposition reaction

ii. Reaction (a) is a precipitation reaction because precipitate of silver chloride is formed as the product. When a product of a chemical reaction is obtained in the form of precipitate (insoluble substance), then that reaction is called a precipitation reaction.

2. Balance the following chemical equations and identify the type of chemical reaction.

- $\text{Mg}(\text{s}) + \text{Cl}_2(\text{g}) \longrightarrow \text{MgCl}_2(\text{s})$
- $\text{HgO}(\text{s}) \xrightarrow{\text{Heat}} \text{Hg}(\text{l}) + \text{O}_2(\text{g})$
- $\text{Na}(\text{s}) + \text{S}(\text{s}) \xrightarrow{\text{Fuse}} \text{Na}_2\text{S}(\text{s})$
- $\text{TiCl}_4(\text{l}) + \text{Mg}(\text{s}) \longrightarrow \text{Ti}(\text{s}) + \text{MgCl}_2(\text{s})$
- $\text{CaO}(\text{s}) + \text{SiO}_2(\text{s}) \longrightarrow \text{CaSiO}_3(\text{s})$
- $\text{H}_2\text{O}_2(\text{l}) \xrightarrow{\text{UV}} \text{H}_2\text{O}(\text{l}) + \text{O}_2(\text{g})$

Ans:

- $$\text{Mg}(\text{s}) + \text{Cl}_2(\text{g}) \longrightarrow \text{MgCl}_2(\text{s})$$

Magnesium Chlorine Magnesium chloride
This is a combination reaction.
- $$2\text{HgO}(\text{s}) \xrightarrow{\text{Heat}} 2\text{Hg}(\text{l}) + \text{O}_2(\text{g})$$

Mercuric oxide Mercury Oxygen
This is a thermal decomposition reaction as well as reduction reaction.
- $$2\text{Na}(\text{s}) + \text{S}(\text{s}) \xrightarrow{\text{Fuse}} \text{Na}_2\text{S}(\text{s})$$

Sodium Sulphur Sodium sulphide
This is a combination reaction.
- $$\text{TiCl}_4(\text{l}) + 2\text{Mg}(\text{s}) \longrightarrow \text{Ti}(\text{s}) + 2\text{MgCl}_2(\text{s})$$

Titanium Magnesium Titanium Magnesium chloride
This is a displacement reaction.
- $$\text{CaO}(\text{s}) + \text{SiO}_2(\text{s}) \longrightarrow \text{CaSiO}_3(\text{s})$$

Calcium Silicon Calcium oxide dioxide silicate
This is a combination reaction.
- $$2\text{H}_2\text{O}_2(\text{l}) \xrightarrow{\text{UV}} 2\text{H}_2\text{O}(\text{l}) + \text{O}_2(\text{g})$$

Hydrogen peroxide Water Oxygen
This is a photochemical decomposition reaction.

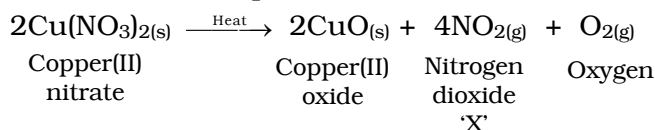
3. On heating blue coloured powder of copper(II) nitrate in a boiling tube, copper oxide (black), oxygen gas and brown gas (X) is formed.

- Write a balanced chemical equation of the reaction.
- Identify the brown gas X evolved.
- Identify the type of reaction.
- What could be the pH range of aqueous solution of the gas X?



Ans:

i. Balanced equation of the reaction:



ii. Nitrogen dioxide is the brown gas 'X' evolved in the given reaction.

iii. The given reaction is thermal decomposition reaction.

iv. Aqueous solution of nitrogen dioxide (i.e., gas 'X' in the given reaction) will have the pH range between 0 to 7 i.e., acidic pH range. This is because oxides of non-metals are generally acidic in nature.

¶4. During the reaction of some metals with dilute hydrochloric acid, following observations were made:

- i. silver metal does not show any change.
 - ii. the temperature of the reaction mixture rises when aluminium (Al) is added.
 - iii. the reaction of sodium metal is found to be highly explosive.
 - iv. some bubbles of a gas are seen when lead (Pb) reacted with the acid.
- Explain these observations giving suitable reasons.

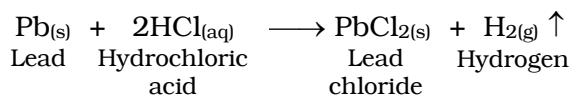
Ans:

i. Silver does not show any change because silver is less reactive than hydrogen. It cannot displace hydrogen from dilute hydrochloric acid.

ii. The reaction between aluminium and hydrochloric acid is exothermic. Thus, temperature of the reaction mixture rises.

iii. Sodium is a highly reactive metal. It reacts with hydrochloric acid vigorously / explosively forming hydrogen gas along with the release of large amount of heat.

iv. When lead (Pb) reacts with HCl, bubbles are seen due to formation of hydrogen gas.



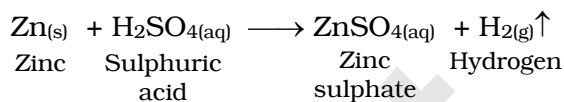
Connections

In Chapter 3, you will study about the reactions of metals with acids.

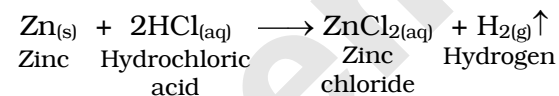
¶5. What happens when zinc granules are treated with dilute solution of H₂SO₄, HCl, HNO₃, NaCl and NaOH? Also write the chemical equations if reaction occurs.

Ans:

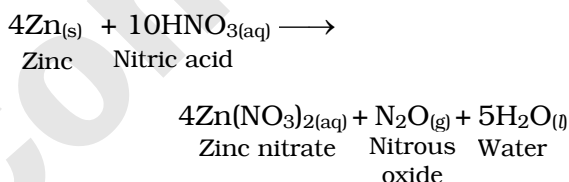
i. Zinc reacts with dilute H₂SO₄ to form zinc sulphate and hydrogen gas.



ii. Zinc reacts with dilute HCl to form zinc chloride and hydrogen gas.

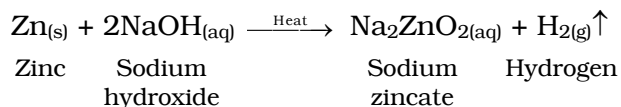


iii. Zinc reacts with dilute cold HNO₃ and forms zinc nitrate, nitrous oxide and water.



iv. Zinc does not react with NaCl.

v. Zinc reacts with sodium hydroxide to form sodium zincate and hydrogen gas.



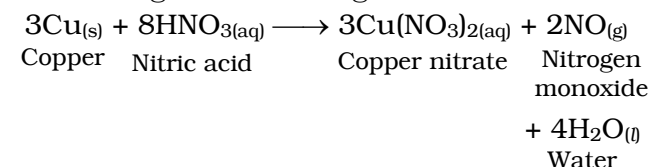
¶6. You are provided with two containers made up of copper and aluminium. You are also provided with solutions of dilute HCl, dilute HNO₃, ZnCl₂ and H₂O. In which of the above containers these solutions can be kept?

Ans:

i. In copper container:

a. Dilute HCl: Copper does not react with dilute HCl. Hence, dilute HCl can be stored in copper container.

b. Dilute HNO₃: Copper reacts with dilute HNO₃ and form copper nitrate and nitrogen monoxide gas.



Hence, dilute HNO₃ cannot be stored in copper container.

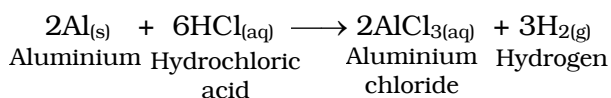


c. **ZnCl₂ solution:** As copper is less reactive than Zn, copper does not displace zinc from ZnCl₂ solution. Therefore, ZnCl₂ solution can be stored in copper container.

d. **H₂O:** No reaction takes place between copper and water. Hence, water can be stored in copper container. Thus, dilute HCl, ZnCl₂ solution and H₂O can be stored in copper container.

ii. **In aluminium container:**

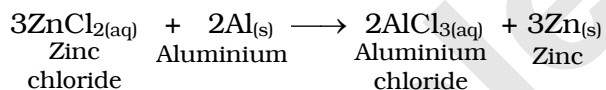
a. **Dilute HCl:** Aluminium reacts with dilute HCl and forms aluminium chloride and hydrogen gas.



Due to this, dilute HCl cannot be stored in aluminium container.

b. **Dilute HNO₃:** Aluminium reacts with dilute HNO₃ and forms aluminium oxide. Once aluminium oxide layer is formed, it does not react further. Hence, dilute HNO₃ can be stored in aluminium container.

c. **ZnCl₂ solution:** ZnCl₂ solution reacts with Al and forms aluminium chloride and zinc metal.



Hence, ZnCl₂ solution cannot be stored in aluminium container.

d. **H₂O:** No reaction takes place between aluminium and water (cold as well as hot water). Hence, water can be stored in aluminium container. Dilute HNO₃ and H₂O can be stored in aluminium container.

*7. **Write the balanced chemical equations for the following and identify the type of reaction in each case.**

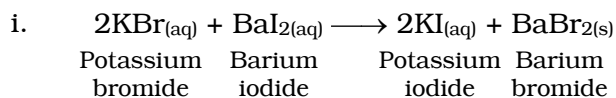
i. Potassium bromide_(aq) + Barium iodide_(aq)
 \longrightarrow Potassium iodide_(aq) + Barium bromide_(s)
 [CBSE 2011]

ii. Zinc carbonate_(s) \longrightarrow Zinc oxide_(s) + Carbon dioxide_(g)

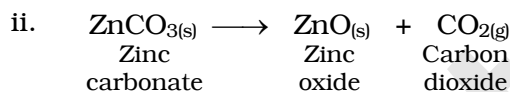
iii. Hydrogen_(g) + Chlorine_(g)
 \longrightarrow Hydrogen chloride_(g)
 [CBSE 2011]

iv. **Magnesium_(s) + Hydrochloric acid_(aq)**
 \longrightarrow Magnesium chloride_(aq) + Hydrogen_(g)

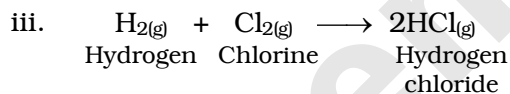
Ans:



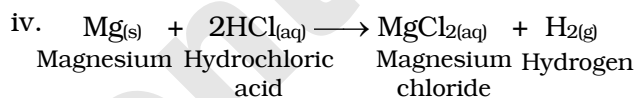
It is a double displacement reaction.



It is a decomposition reaction.



It is a combination reaction.



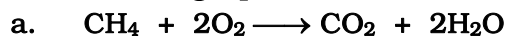
It is a displacement reaction.

8.

i. **What is oxidation - reduction reaction? Justify your answer by writing one such chemical equation and name the substance oxidised and the substance reduced in it.**

[CBSE 2012]

ii. **Identify the type of reaction from the following equations:**

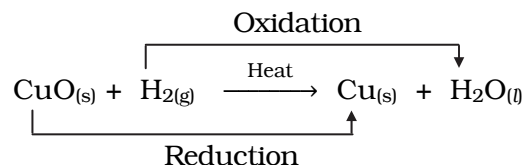


[CBSE 2012]

Ans:

i. a. Chemical reaction in which one substance is oxidised and other is reduced is called oxidation-reduction reaction or redox reaction.

b.



Substance oxidised : H₂

Substance reduced : CuO

ii. a. Combustion and redox reaction

b. Double displacement and precipitation reaction



9.
i. Manganese dioxide when reacts with hydrochloric acid forms manganese chloride, water and chlorine.
a. Express the above reaction in the form of a balanced chemical equation.
b. Identify
1. reducing agent
2. oxidising agent [CBSE 2011]
ii. Identify the type of reaction from the following equations:
a. $\text{CaO} + \text{H}_2\text{O} \longrightarrow \text{Ca(OH)}_2$
b. $\text{CuSO}_4 + \text{Zn} \longrightarrow \text{ZnSO}_4 + \text{Cu}$ [CBSE 2012]

Ans:

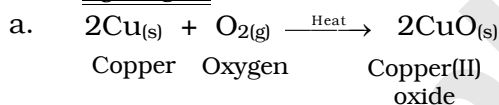
- i. a. $\text{MnO}_2 + 4\text{HCl} \longrightarrow \text{MnCl}_2 + 2\text{H}_2\text{O} + \text{Cl}_2$
b. 1. Reducing agent - HCl
2. Oxidising agent - MnO_2
ii. a. Combination reaction
b. Displacement reaction and redox reaction

- *10. Explain the following in terms of gain or loss of oxygen with two examples each:

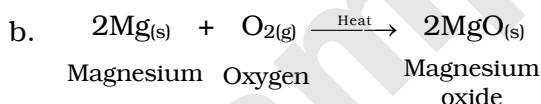
- i. Oxidation ii. Reduction

Ans:

- i. **Oxidation:** It is a process in which substance gains oxygen or loses hydrogen

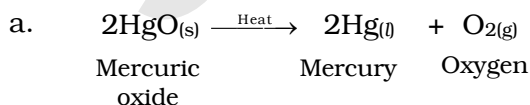


Here, Cu is oxidised to CuO.

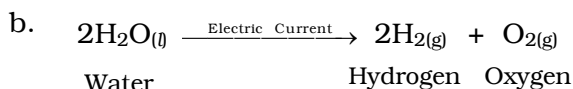


Here, Mg is oxidised to MgO.

- ii. **Reduction:** It is a process in which substance loses oxygen or gains hydrogen.



Here, mercuric oxide is reduced to mercury.

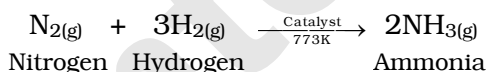


Here, water is reduced to hydrogen.

- *11. Write the balanced chemical equations for the following reactions and identify the type of reaction in each case.

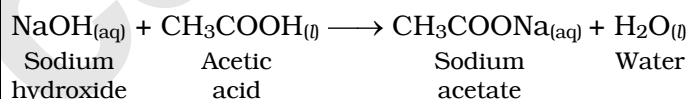
- i. Nitrogen gas is treated with hydrogen gas in the presence of a catalyst at 773 K to form ammonia gas.
ii. Sodium hydroxide solution is treated with acetic acid to form sodium acetate and water.
iii. Ethanol is warmed with ethanoic acid to form ethyl acetate in presence of concentrated H_2SO_4 .
iv. Ethene is burnt in the presence of oxygen to form carbon dioxide, water and releases heat and light.

Ans:



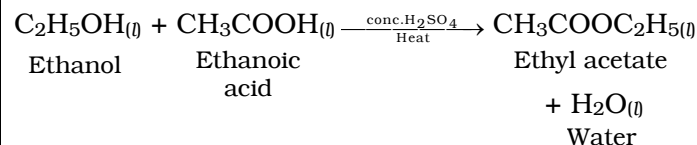
This is a combination as well as reduction reaction.

- ii.

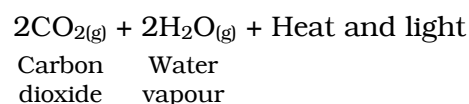
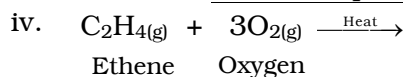


This is a double displacement reaction.

- iii.



This is a double displacement reaction.



This is a redox reaction, combustion reaction and also an exothermic reaction.

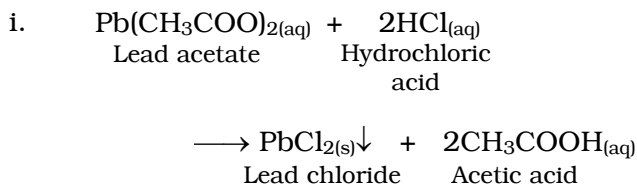
- *12. Write a balanced chemical equation for each of the following reaction and also classify them.

- i. Lead acetate solution is treated with dilute hydrochloric acid to form lead chloride and acetic acid solution.
ii. A piece of sodium metal is added to absolute ethanol to form sodium ethoxide and hydrogen gas.

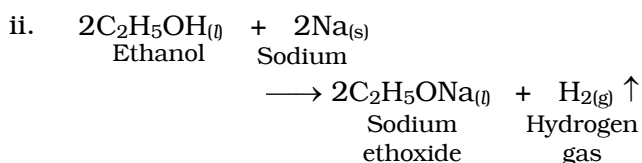


- iii. Iron(III) oxide on heating with carbon monoxide gas reacts to form solid iron and liberates carbon dioxide gas.
- iv. Hydrogen sulphide gas reacts with oxygen gas to form solid sulphur and liquid water.

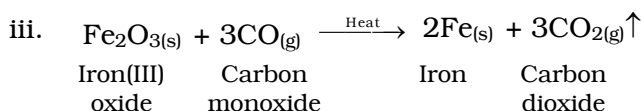
Ans:



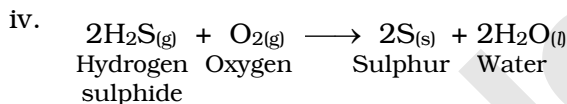
This is a double displacement as well as precipitation reaction.



This is a displacement reaction.



This is a redox reaction.

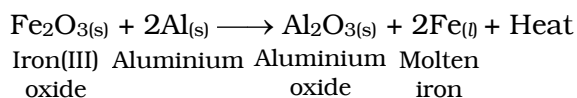


This is a redox reaction.

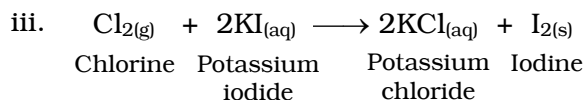
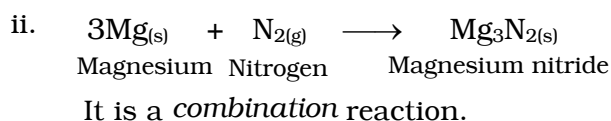
¶13. Write the balanced chemical equations for the following reactions and identify the type of reaction in each case.

- Thermite reaction, iron(III) oxide reacts with aluminium and gives molten iron and aluminium oxide
- Magnesium ribbon is burnt in an atmosphere of nitrogen gas to form solid magnesium nitride.
- Chlorine gas is passed in an aqueous potassium iodide solution to form potassium chloride solution and solid iodine.
- Ethanol is burnt in air to form carbon dioxide, water and releases heat.

Ans:

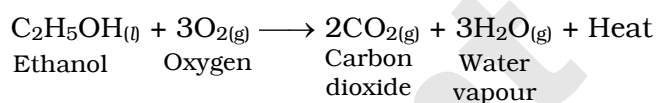


It is a displacement reaction and an exothermic reaction.



It is a displacement reaction.

iv.



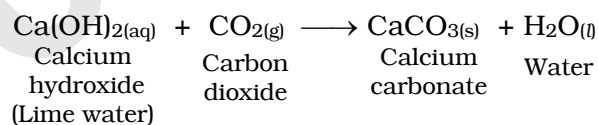
It is a redox, combustion and an exothermic reaction.

¶14. Give the characteristic tests for the following gases:

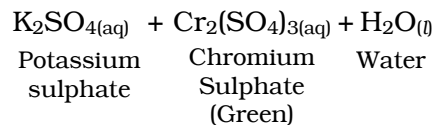
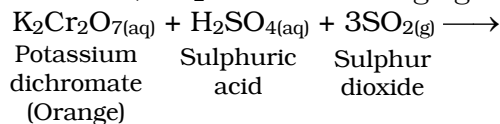
- CO₂
- SO₂
- O₂
- H₂

Ans: Characteristic tests:

- CO₂: Pass the CO₂ gas through lime water. It will turn lime water milky. This occurs due to formation of calcium carbonate.





- SO₂: Pass the SO₂ gas through acidified potassium dichromate solution (orange in colour). The acidified potassium dichromate solution changes to green in colour due to formation of Cr₂(SO₄)₃. In this reaction, SO₂ act as reducing agent.



- O₂: Bring a burning candle near the mouth of the test tube containing a reaction mixture. If oxygen gas is present, then the intensity of the candle flame increases as oxygen supports combustion.
- H₂: Bring a burning splinter near the mouth of the test tube containing a reaction mixture. Hydrogen gas, if present, will burn with pop sound.



Case/Source Based Questions [4 Marks]

1. In a chemistry lab, Beena takes 1 g of silver chloride in a china dish. She keeps the dish near the window of the lab.   Silver chloride
- After a few hours she notices that the silver chloride turned grey when exposed to sunlight. On the basis of the above reaction, answer the following questions.
- Write balanced chemical equation for the reaction.
 - Mention one commercial use of silver chloride.
 - Is this a decomposition reaction? Justify your answer.

OR

- Indicate whether energy is absorbed or released in this reaction. Based on this, identify the type of reaction.

Ans:

- $2\text{AgCl}_{(s)} \xrightarrow{\text{Sunlight}} 2\text{Ag}_{(s)} + \text{Cl}_{2(g)}$
- Silver chloride is used in black and white photography.
- Yes, it is a decomposition reaction as a single reactant breaks down to give simpler products.

OR

- Energy (in the form of light) is absorbed in the reaction. It is an endothermic reaction.
2. A student takes four test tubes and adds zinc sulphate solution, lead chloride solution, ferrous sulphate solution and silver nitrate solution into the test tubes and labels them as P, Q, R and S respectively. He adds a small thin piece of copper metal in all of them as shown below.



ZnSO_{4(aq)}
(P)

PbCl_{2(aq)}
(Q)

FeSO_{4(aq)}
(R)

AgNO_{3(aq)}
(S)

- Will he observe the deposition of silver on copper metal in test tube S? Explain.

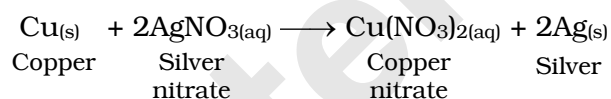
- What is the colour of the solution in test tube R before and after the addition of copper metal?

OR

- In which test tubes, there will be no reaction taking place? Why?

Ans:

- Yes, he will observe the deposition of silver on copper metal in test tube S. Copper is more reactive than silver. Hence, copper will displace silver from silver nitrate solution forming copper nitrate and silver.



- The colour of the solution in test tube R is pale green both before and after the addition of copper metal. This is because no reaction takes place in test tube R as copper is less reactive than iron.

OR

- An element can displace other elements from their aqueous salt solutions only if it is more reactive than those elements. Since zinc, lead and iron, all three are more reactive than copper, copper cannot displace any of them from their aqueous solutions. Hence, there will be no reaction in test tubes P, Q and R.

Practice Questions

- Give an example each for thermal decomposition and photochemical decomposition reactions. Write relevant balanced chemical equations also. [CBSE 2012]

Ans: Refer 1.2 Short Answer Questions Q.10. (i) and (ii).

- Using balanced chemical equation explain the difference between a displacement reaction and double displacement reaction.

[CBSE 2011, 12]

Ans: Refer 1.2 Short Answer Questions Q.17.



3. You might have noted that when copper powder is heated in a china dish, the surface of copper powder becomes coated with a black colour substance.
- What is that black substance?
 - Write the chemical equation of the reaction that takes place.

[CBSE 2011]

Ans: Refer 1.2 Short Answer Questions Q.20.

1.3 Oxidation reactions in everyday life

- Corrosion:**
Metals get attacked by substances around it such as moisture, acids, etc. Metal is said to 'corrode' due to this attack and the process is called **corrosion**.
 Many metals like iron, silver, copper, etc. get corroded. However, corrosion of iron is a serious problem as enormous amount of money is spent every year to replace damaged iron.
- Rancidity:**
 Rancidification is a process in which substance containing fats and oils gets oxidised and their odour or taste becomes disagreeable, when kept for long time. Following methods can prevent rancidification of foods:
 - Addition of antioxidants to food
 - Use of nitrogen gas
 - Use of airtight containers.

Objective Questions

Multiple Choice Questions [1 Mark]

- ⌘1. Which of the following gases can be used for storage of fresh sample of an oil for a long time?
- Carbon dioxide or oxygen
 - Nitrogen or oxygen
 - Carbon dioxide or helium
 - Helium or nitrogen**

Hint: To prevent rancidification of foods containing fats and oils, the packed food is surrounded by unreactive gas (like helium, nitrogen, etc.). The inert atmosphere thus created prevents oxidation of fats and oils.

Assertion & Reason [1 Mark]

1. **Assertion:** Foodstuffs become rancid when kept for a long time.
Reason: Antioxidant are used to prevent rancidity of foodstuffs.
- Assertion is True, Reason is True; Reason is a correct explanation for Assertion.**
 - Assertion is True, reason is True; Reason is not a correct explanation for Assertion.
 - Assertion is True, Reason is False.
 - Assertion is False, Reason is True.

Hint: When foodstuffs are kept for a long time, they become rancid due to oxidation. Antioxidants prevent oxidation of foodstuffs and hence, they are added to prevent them from becoming rancid.

Subjective Questions

Very Short Answer Questions [2 Marks]

- ⌘1. **Why do fire flies glow at night?**
Ans:
- Fire flies contain protein luciferin in them. This protein gets oxidised in the presence of atmospheric oxygen.
 - This oxidation reaction is accompanied by emission of light. Thus, fire flies glow at night.
- ⌘2. **A silver article generally turns black when kept in open for a few days. The article when rubbed with toothpaste again starts shining.**
- Why do silver articles turn black when kept in the open for a few days? Name the phenomenon involved.**
 - Name the black substance formed and give its chemical formula.**
- Ans:**
- Silver reacts with hydrogen sulphide gas present in air and forms a compound Ag_2S . This compound is black in colour. Hence, silver articles turn black when kept in the open for a few days. This phenomenon is called corrosion.
 - The black substance formed is silver sulphide. Its chemical formula is Ag_2S .



3. Surface of some metals loses their brightness when kept in air for a long time. Why? [CBSE 2010]

Ans: When certain metals like magnesium, aluminium, etc., are exposed to air, they form an oxide film on their surfaces. Thus, the surface loses its brightness when kept in air for a long time.

GG - Gyan Guru

Chemistry of Lost Treasure in Sea

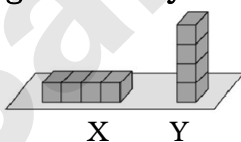
When Atocha ship was destroyed in 1622, it contained approximately 47 tons of bulk of the treasure such as bars and coins of copper, gold and silver packed in wooden chests.

When treasure hunter Mel Fisher salvaged the silver in 1985, corrosion and marine growth had transformed the silver metal into something which looked like coral.



As the wooden chests containing the silver decayed, the oxygen supply was depleted which favored the growth of certain bacteria that use the sulfate instead oxygen as an oxidizing agent. As these bacteria consumed sulfate ions and released hydrogen sulfide gas that reacted with silver to form black silver sulfide. Thus, over the years, the surface of the silver corroded which prevented the silver underneath and thus prevented total conversion of the silver to silver sulfide.

4. Eight identical, iron blocks are placed on the ground in the two arrangements X and Y as shown below. The block arrangements are kept moist by sprinkling water every few hours.



Which of the arrangements is likely to gather more rust after ten days? Justify your answer.

[CBSE Competency Focused Practice Questions 2022-23]

Ans:

- Arrangement 'Y' is likely to gather more rust.
- The process of rusting is a surface phenomenon. Arrangement 'Y' has a larger surface area exposed to air and moisture. Hence, arrangement 'Y' is likely to gather more rust.

- *5. Why do we apply paint on iron articles?

Ans:

- Moist air attacks the surface of iron articles and causes rusting (i.e., corrosion of iron).
- Contact between iron and moist air can be avoided by applying paint on iron articles. This prevents rusting and protects the iron articles from damage for many years.

- *6. Oil and fat containing food items are flushed with nitrogen. Why?

Ans:

- Oil and fat containing food items get oxidised in presence of oxygen and become rancid.
- Flushing of these food items with nitrogen avoids their contact with oxygen and inturn prevents rancidity.

7. To prevent rancidity of food containing fats or oils, some substances are added to them. What are these substances called? Suggest some other method to prevent rancidity of food items. [CBSE 2012]

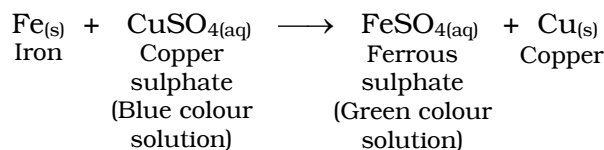
Ans:

- To prevent rancidity, substances called 'antioxidants' are added to food (that contains fats and oils.)
- Rancidity can also be prevented:
 - By flushing packets of food items like chips with nitrogen.
 - By storing the food in airtight container to slow down the process of oxidation.

Short Answer Questions [3 Marks]

- #1. Why does the colour of copper sulphate solution change when an iron nail is dipped in it?

Ans: The colour of copper sulphate solution is blue. When an iron nail is dipped in solution of copper sulphate, iron displaces copper. Ferrous sulphate and copper are formed due to displacement reaction. Colour of ferrous sulphate solution is green. Hence, the colour of copper sulphate solution changes when an iron nail is dipped in it.





*2. Explain the following terms with one example each:

- i. Corrosion [CBSE 2015]
- ii. Rancidity

Ans:

i. The process of slow degradation of the metals due to the attack of atmospheric gases, moisture, acids, etc. on the surface of metals is called corrosion.

eg. Iron forms reddish brown coloured coating on its outer surface due to corrosion.

ii. **Rancidity:** The oxidation of oils and fats in foods resulting into a bad smell and bad taste is called rancidity. As a result of this oxidation, the food becomes rancid and unfit for consumption.

eg. Cooking oil kept for long time will become rancid.

3.

i. State the reason for the following:

a. Potato chips manufacturers fill the packet of chips with nitrogen gas.

b. Iron articles are shining when new, but get coated with a reddish brown powder, when left for some time. [CBSE 2014]

ii. What is the colour of the coating formed on copper articles due to corrosion?

Ans:

i. a. Potato chips manufacturers fill the packet of chips with nitrogen gas to prevent oxidation of fats and oils present in the chips and thereby avoiding its rancidity.

b. When iron comes in contact with moist air, it reacts with oxygen in presence of moisture and forms rust (hydrated oxide of iron) which is reddish brown in colour.

ii. A green coloured coating is formed on copper articles due to corrosion.

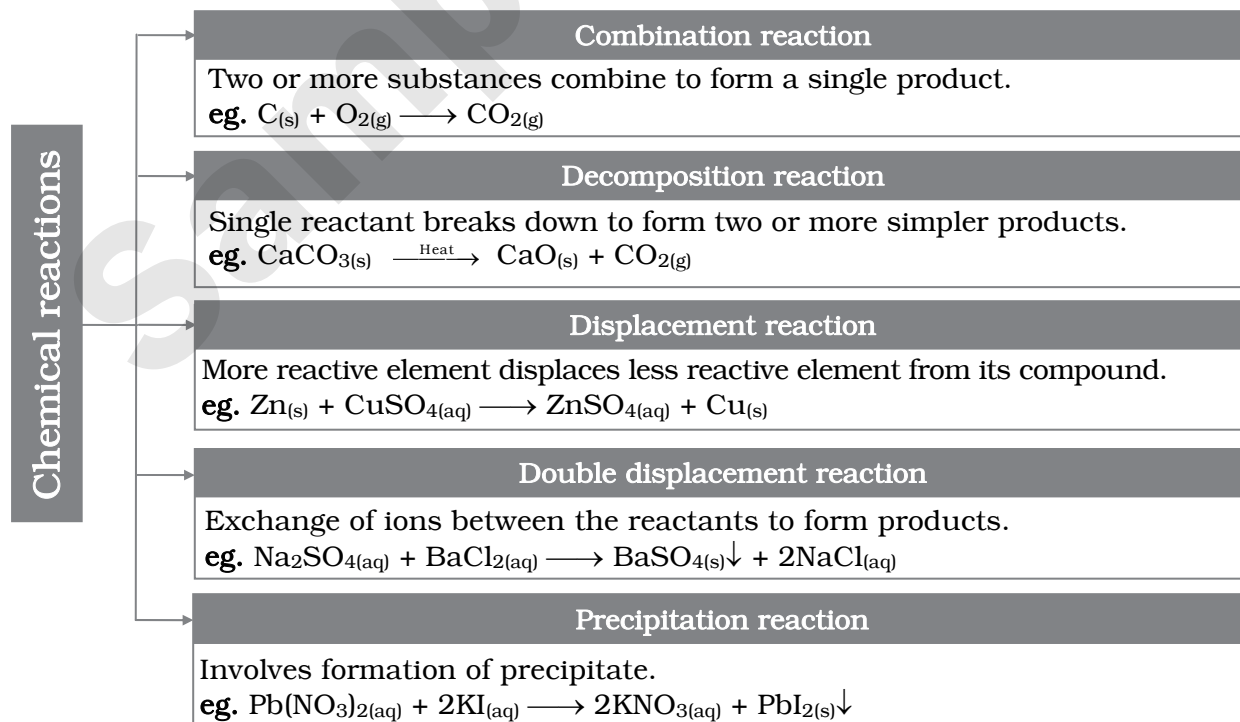
Practice Questions

1. Define rancidity. [CBSE 2012]

Ans: Refer 1.3 Short Answer Questions Q.2 (ii)

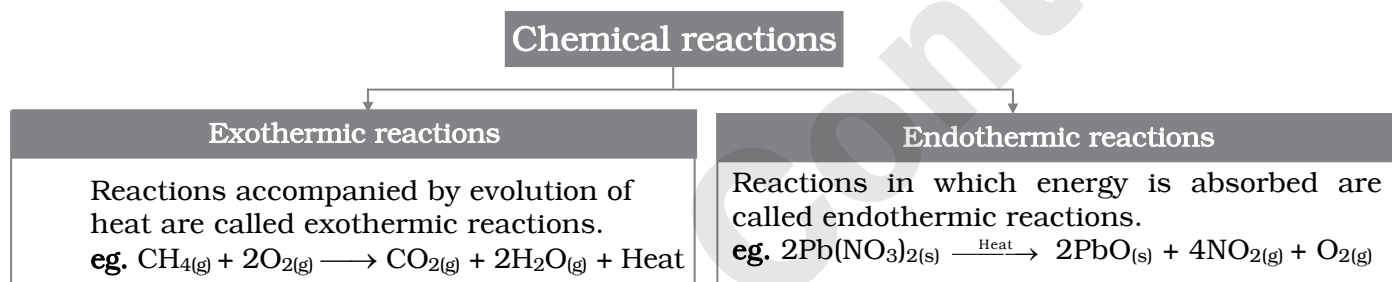
Memory Map

Classification of chemical reactions based on chemical change





Oxidation reaction
Substance gains oxygen or loses hydrogen. eg. $2\text{Cu}_{(s)} + \text{O}_{2(g)} \xrightarrow{\text{Heat}} 2\text{CuO}_{(s)}$
Reduction reaction
Substance gains hydrogen or loses oxygen. eg. $\text{C}_{(s)} + 2\text{H}_{2(g)} \longrightarrow \text{CH}_{4(g)}$
Redox reaction
One reactant gets oxidised and other reactant gets reduced. eg. $\begin{array}{c} \text{CuO} + \text{H}_2 \xrightarrow{\text{Heat}} \text{Cu} + \text{H}_2\text{O} \\ \text{Oxidation} \quad \quad \quad \text{Reduction} \end{array}$

Classification of chemical reactions based on energy change**Competitive Corner**

- Nitrogen dioxide is released by heating _____. [MHT CET 2003]
 (A) $\text{Pb}(\text{NO}_3)_2$ (B) KNO_3
 (C) NaNO_2 (D) NaNO_3
- Which of the following chemical reactions depicts the oxidizing behaviour of H_2SO_4 ? [AIEEE 2006]
 (A) $2\text{HI} + \text{H}_2\text{SO}_4 \longrightarrow \text{I}_2 + \text{SO}_2 + 2\text{H}_2\text{O}$
 (B) $\text{Ca}(\text{OH})_2 + \text{H}_2\text{SO}_4 \longrightarrow \text{CaSO}_4 + 2\text{H}_2\text{O}$
 (C) $\text{NaCl} + \text{H}_2\text{SO}_4 \longrightarrow \text{NaHSO}_4 + \text{HCl}$
 (D) $2\text{PCl}_5 + \text{H}_2\text{SO}_4 \longrightarrow 2\text{POCl}_3 + 2\text{HCl} + \text{SO}_2\text{Cl}_2$
- Hot concentrated sulphuric acid is a moderately strong oxidizing agent. Which of the following reactions does NOT show oxidizing behaviour? [NEET (UG) 2016]
 (A) $\text{CaF}_2 + \text{H}_2\text{SO}_4 \longrightarrow \text{CaSO}_4 + 2\text{HF}$
 (B) $\text{Cu} + 2\text{H}_2\text{SO}_4 \longrightarrow \text{CuSO}_4 + \text{SO}_2 + 2\text{H}_2\text{O}$
 (C) $2\text{S} + 2\text{H}_2\text{SO}_4 \longrightarrow 2\text{SO}_2 + 2\text{H}_2\text{O}$
 (D) $\text{C} + 2\text{H}_2\text{SO}_4 \longrightarrow \text{CO}_2 + 2\text{SO}_2 + 2\text{H}_2\text{O}$
- Which of the following compounds is known as slaked lime? [MHT CET 2020]
 (A) CaO (B) CaCO_3
 (C) CaSO_4 (D) $\text{Ca}(\text{OH})_2$
- Identify the reducing agent in the following reaction. [MHT CET 2020]
 (A) $\text{CO}_{2(g)}$ (B) $\text{O}_{2(g)}$
 (C) $\text{H}_2\text{O}_{(l)}$ (D) $\text{CH}_{4(g)}$

SECTION - A

Select and write one most appropriate option out of the four options given for each of the questions 1 – 6.

- Which of the following is(are) an endothermic process(es)?
 - Dilution of sulphuric acid
 - Sublimation of dry ice
 - Condensation of water vapours
 - Evaporation of water

(A) ii only (B) i and iii (C) ii and iv (D) iii only
- When steam is passed through red hot iron, iron oxide and hydrogen gas is formed.
The balanced equation for the reaction is shown below.

$$3\text{Fe} + 4\text{H}_2\text{O} \longrightarrow \text{Fe}_3\text{O}_4 + 4\text{H}_2$$

(Iron) (Water) (Iron oxide) (Hydrogen)

What is true for the balanced chemical equation shown above?

(A) Four atoms of water combine with iron to form four atoms of hydrogen.
 (B) Three atoms of iron combine with water to form four atoms of hydrogen.
 (C) Four molecules of water combine with iron to form an atom of iron oxide.
 (D) Three atoms of iron combine with water to form one molecule of iron oxide.
- Some reactions require conditions like specific temperature, pressure, etc. While writing chemical equations for such reactions, where are these conditions usually mentioned?

(A) Above the arrow (B) Along with products
 (C) Below the plus signs (D) Before the reactants
- Which of the following will form a white precipitate when they are mixed?

(A) Barium chloride solution and sodium sulphate solution
 (B) Lead(II) nitrate solution and potassium iodide solution
 (C) Iron filings and copper sulphate solution
 (D) Zinc granules and sulphuric acid
- $w\text{SnO}_2 + x\text{H}_2 \longrightarrow y\text{Sn} + z\text{H}_2\text{O}$
For which of the following values of w, x, y and z will the equation above be balanced?

(A) $w = 1, x = 1, y = 1, z = 1$ (B) $w = 1, x = 2, y = 2, z = 1$
 (C) $w = 1, x = 2, y = 1, z = 2$ (D) $w = 1, x = 1, y = 1, z = 2$
- Assertion:** Respiration is an exothermic process.
Reason: Reactions in which energy is absorbed are known as endothermic reactions.

(A) Assertion is True, Reason is True; Reason is a correct explanation for Assertion.
 (B) Assertion is True, reason is True; Reason is not a correct explanation for Assertion.
 (C) Assertion is True, Reason is False.
 (D) Assertion is False, Reason is True.



SECTION – B

7. The reaction between magnesium and oxygen produces magnesium oxide. Energy is released as heat and light during the reaction. Explain why the reaction can be described as:
- a combination reaction.
 - an oxidation reaction.
8. What is decomposition reaction? Explain with suitable example.

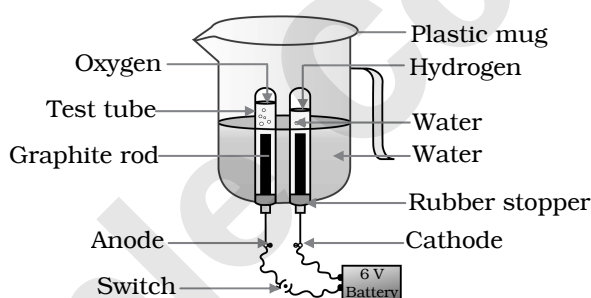
SECTION – C

9. Translate the following statements into chemical equations and then balance the equations:
- Phosphorus burns in oxygen to give phosphorus pentoxide.
 - Copper sulphate reacts with iron to form iron sulphate and copper.
 - Aluminium metal replaces iron from ferric oxide, Fe_2O_3 , which gives aluminium oxide and iron.

OR

Balance the following chemical equations:

- $\text{Mg}(\text{OH})_2 + \text{H}_2\text{SO}_4 \longrightarrow \text{MgSO}_4 + \text{H}_2\text{O}$
 - $\text{Al} + \text{CuCl}_2 \longrightarrow \text{AlCl}_3 + \text{Cu}$
 - $\text{Pb}(\text{NO}_3)_2 + \text{KI} \longrightarrow \text{KNO}_3 + \text{PbI}_2$
10. The diagram below shows the set-up in which electrolysis of water takes place.



- What type of reaction takes place: combination or decomposition reaction? Explain.
- Preeti suggests that the reaction is an example of endothermic reaction. Do you agree with her? Justify your answer.
- Write balanced chemical equation of the reaction occurring.

SECTION – D

11. When blue coloured powder of copper nitrate is heated in boiling tube, copper oxide (black), oxygen gas and brown gas 'X' is formed.
- Identify the brown gas 'X' formed.
 - Write a balanced chemical equation of the reaction.
 - State the type of reaction.
 - Aqueous solution of the gas 'X' will be acidic or basic?

OR

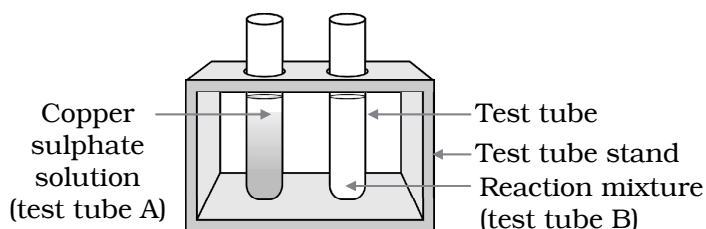
A compound P on heating gives a solid Q and gas R. Q is used intensively in the cement industry and is an oxide of a group 2 element. The compound Q reacts vigorously with water to produce compound S releasing a large amount of heat. Identify P, Q, R and S, also write chemical reactions involved.

**SECTION – E**

12. Read the following passage and answer the questions given below.

[4]

Seema sets up an experiment to investigate the reaction of zinc with copper sulphate solution. She puts a zinc plate into a solution of copper sulphate kept in test tube A.



After some time, she notices that blue colour of the solution gets fader and fader with the passing time as shown in test tube B. She also observes that a dark coating of copper metal appears on the zinc plate.

- On the basis of the above given information, is the reaction between zinc and copper sulphate solution a displacement reaction? Justify your answer.
- Gauri uses iron nail instead of zinc plate for the same above experiment. What will be the colour of the solution in test tube B after the reaction? Write the chemical equation of this reaction.

OR

- What will happen if silver metal is added to copper sulphate solution? Explain.

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